The Devil in the Demographics

How Neo-Malthusian Population Pressure and Youth Bulges Influence the Risk of Domestic Armed Conflict

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Preface

I have benefited greatly from my association with two excellent research environments during my work with this thesis: the International Peace Research Institute, Oslo (PRIO), where my study has been associated with the Environmental Change, Good Governance, Development and Human Security (GECHS) project of the Conditions of War and Peace Program (CWP), and Section for Demography, Department of Economics at the University of Oslo.

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Remaining errors are my responsibility alone.

1. Introduction

Armed conflicts pose a great risk to a large number of peoples' lives and well-being around the world. Internal armed conflicts are far more frequent than interstate conflicts. While there was an increase in the number of internal conflicts immediately after the end of the Cold War, such conflicts now occur approximately as frequently as for the late Cold War period. In 2000, 33 armed conflicts with more than 25 battle-related casualties took place in 27 different countries. In 12 of these conflicts more than 1,000 people were killed. Thirty-one out of the 33 conflicts were domestic (Wallensteen & Sollenberg, 2001). Explanations for the outbreak of conflicts are diverse. The purpose of this thesis is to test claims that demographic factors may be causally linked to internal armed conflict.

The social and human implications of armed conflict are enormous. The most devastating conflicts that happened in the past decade demanded high death tolls. During the Rwandan genocide[1] in 1994 an estimated 800 to 850,000 people were killed (Prunier, 1995), while the Bosnian civil war from 1992 to 1995 cost the lives of more than 200,000 people (Allcock, Milivojevic & Horton, 1998: 38). But in many armed conflicts, the number of people dying from indirect causes of conflict such as under- and malnutrition, or diseases that could easily be treated if medicines were available, is much higher than the number of battle-related deaths. Armed conflict is also harmful to economic development and the environment, especially in poor countries. In several works, Paul Collier, Director of the Development Research Department of the World Bank, has shown that conflict can tear down levels of economic development that took

[1] Genocides can happen in the absence of armed conflict. An armed conflict demands two active parts fighting each other, while genocides can take place as an action against a defenseless civil population. In this thesis I refer to the Rwandan genocide at some occasions because the genocide in 1994 is frequently explained by high population pressure on land resources. However, according to the conflict data used here (Gleditsch et al., 2001), those who were killed during the genocide are not counted as casualties of the Rwandan civil war lasting from 1990-94, implying that the genocide is not viewed as part of the actual military activities. While this interpretation of the Rwandan genocide is disputed, it is also of little importance to the way that I have referred to the genocide in this thesis. The Rwandan genocide was clearly associated with the armed conflict between the Hutu-dominated government and the Tutsi-led RPF guerillas, and I believe that it is likely that the same root causes apply to both the armed conflict and to the genocide.

decades to achieve. Also, for a long time after the termination of conflict, spin-off effects continue to hamper economic growth (Collier, 1999).

My aim is to clarify whether *population pressure* is a contributing cause to domestic armed conflict, and my main research hypothesis is that:

> Countries with high population pressure are more likely to experience domestic armed conflict than countries with low population pressure.

I will look at two distinct forms of population pressure. One is derived from a neo-malthusian definition of population pressure, and focuses on population growth and density. The other is youth bulges.

The *neo-malthusian* claim is that population growth in a society leads to scarcity of natural resources, first because more people have to share the limited resource base available and second because when too many people are sharing a resource this increases the risk that the resource will be overused and depleted. Resource scarcities are believed to lead to increased inter-group competition, and under unfavorable economic and political conditions, such competition can take the form of violent conflict.

I contrast the resource pessimist neo-malthusian perspective with a resource-optimistic or *cornucopian* view. Cornucopians concede the neo-malthusians premise that more people means less resources per person. They believe, however, that an increased pressure on resources leads to innovation and implementation of new technology that make resource scarcity and resource dependency increasingly less likely. Population pressure is thus believed to be either a neutral factor among determinants of armed conflict, or even a possible contributor to economic growth that can reduce conflict propensity in the longer run.

The second form of population pressure that I investigate is the existence of *youth bulges*. A youth bulge is defined as an extraordinary large cohort of youth relative to the adult population. Youth bulges are not believed to put pressure on natural resources, but rather on social institutions such as the labor market and the educational system, thereby causing grievances that may result in violent conflict.

I restrict the study to domestic armed conflict because the neo-malthusian theory that I aim to test relates empirically to episodes of internal conflict. Another argument for focusing on domestic conflicts is that this is by far the most frequent type of conflict today and thus the most serious threat to human security and development. I will use a new set of conflict data that includes all conflicts with a minimum of 25 battle-related deaths (Gleditsch et al., 2001). In the following, the term 'conflict' or 'armed conflict' will mean domestic armed conflict unless specified otherwise.

The reason why I have set out to test neo-malthusian theories is the prominent position held by such theories in the current discussion over causes of conflict, and the lack of rigorous empirical studies. The debate over the implications of population pressure on renewable resources dates back at least to Thomas Malthus' (1803/1992) concerns that population would exceed food production. This debate has been at the core of development research since Malthus (Ohlsson, 1999: 3), although with the pendulum swinging between pessimistic and optimistic positions through the times. A more pessimistic view reemerged in the middle of the period studied here. In the 1960s and through the 1970s, the world saw an explosion in literature concerned with population and environmental matters, and with titles such as *The Population Bomb* (Ehrlich, 1968). This pessimistic view was also reflected in policy-making establishments, especially in the US. In 1965, Lyndon B. Johnson said that he would 'seek new ways to use our knowledge to help deal with the explosion in world population and the growing scarcity in world resources' (Green, 1993: 305). And while non-renewable resources such as oil and minerals had long been considered to be security issues, population pressure and renewable resources were 'considered as an extremely uninteresting factor in studying causes of conflict in the era of developmental optimism' (Ohlsson, 1999: 25). Some isolated cases were however identified in this period (ibid.).

A new and more pronounced round of neo-malthusian concern for security arrived in the 1990s. Explanations for this have been twofold. First, environmental concern had been increasing in Western opinion in this period, and environmental protagonists succeeded in 'securitizing' central environmental issues, and thereby attracting the attention of policymakers (Levy, 1995: 44). In the US, vice president Al Gore

initiated the 'State Failure Task Force' project in 1994 aimed at revealing environmental, political and social causes of state failure. Second, the end of the Cold War left a void in security policy, and Western national security establishments sought ways to legitimize their continued existence (Gleditsch, 2001a: 259). In a statement to the Senate Committees on Intelligence held in 1997, Director of the Defense Intelligence Agency Patrick M. Hughes argued that despite the lack of a 'peer competitor' to the US after the end of the Cold War, 'the world remains a very dangerous and complex place and there is every reason to expect US military requirements at about the same level of the past several years' (Hughes, 1997: 11). When listing the conditions that he believed would continue to make the world a dangerous place, the existence of youth bulges was his first point, while resource scarcities following from rapid population growth was number three on his list (ibid.: 2).

Not only does the association of population growth, resource scarcity and youth bulges with an increased risk of instability and armed conflict have a long history, but many claim that demographic and environmental factors have become *more important* after the end of the Cold War. One example is the widely cited article 'The Coming Anarchy' by free-lance journalist Robert Kaplan, where he argues that 'West Africa is becoming *the* symbol of worldwide demographic, environmental and societal stress', and that anarchy and the crumble away of nation states will be attributed to such factors in the future (Kaplan, 1994: 46, emphasis in original). de Soysa (2002: 3) argues that ecological and demographic pressures are popularly seen as explanations for a 'new age of insecurity' after the end of the Cold War.

Also, after the terrorist attacks on the US on 11 September 2001 youth bulges have become a very popular explanation for current political instability in the Arab world and for recruitment to terrorist organizations.[2] In a background article surveying the causes of the terrorist attacks, *Newsweek* editor Fareed Zakaria argues that '[g]lobalization has caught [the Arab world] at a bad demographic moment. Arab so-

[2] This interest even led to *New York Times* citing the conference paper on youth bulges that I presented to the ECPR conference in Canterbury, UK in September 2001 (Sciolino, 2001). The title of the *NYT* article was 'Is the Devil in the Demographics?', from which I have borrowed the title of this thesis.

cieties are going through a massive youth bulge, with more than half of most countries' populations under the age of 25' (Zakaria, 2001: 24). Zakaria believes that youth bulges combined with small economic and social change has provided a fundament for an Islamic resurgence in the Arab world (ibid.).

In this study I will put such notions to an empirical test. My research hypotheses will be tested through an event history statistical model covering a high number of countries and politically dependent areas over the period 1950–2000, using several different indicators of population pressure. The advantage of this approach is that I am able to test my hypotheses over a large variety of contexts. Many case studies in this field have been criticized for selecting cases that fit the theory. I hope that my approach may yield more representative results.

The thesis is structured in the following way: In Chapter 2 I present neo-malthusian theoretical perspectives and cornucopian objections, and discuss under what conditions the neo-malthusian conflict scenario may hold. I further discuss theoretically how youth bulges may influence the risk of conflict. In Chapter 3 I describe in very general terms what factors that cause population growth and other kinds of population changes. The chapter also provides statistics on important demographic trends for the period covered by this thesis. Chapter 4 contains the methodological presentation and discussion, and the operationalization of my variables. In Chapter 5 I present my empirical analysis, while I aim to develop an overall perspective and conclusion in Chapter 6.

The main finding of this thesis is that neo-malthusian indicators of population pressure do not seem to be related to domestic armed conflict. Rather, I find some evidence for an alternative cornucopian hypothesis suggesting that high population density may actually lead to a decreased risk of armed conflict. I do, however, find rather robust evidence for a positive relationship between youth bulges and domestic armed conflict.

2. Demographic Violence

2.1 Neo-Malthusian Population Pressure

One of the greatest sources of inspiration for students of the population-resource nexus has been Thomas Robert Malthus' *An Essay on the Principle of Population* (Malthus, 1803/1992). In his highly influential and alluringly simplistic theory of the relation between population and food availability, Malthus assessed that food production would grow arithmetically (1, 2, 3, 4 etc), while the human population would grow exponentially (1, 2, 4, 8 etc). An obvious consequence of such a view is that at some point there is just not enough food to go around. Malthus termed nature's response to this disequilibrium between people and food 'positive checks'. Such checks were causes 'which in any degree contributes to shorten the natural duration of human life' and included 'wars, [...] plague and famine' (Malthus, 1803/1992: 23).

History has to a considerable extent proven Malthus wrong. Food production has increased more than he expected, while population has grown more slowly. However, the idea that the human population cannot continue to grow indefinitely without at some point reaching and exceeding the carrying capacity of the earth has, understandably, survived. And at the end of the 1960s and the beginning of the 1970s, a wave of alarmist 'neo-malthusian' literature emerged, predicting that the rapidly growing world population would soon exceed the resource base and lead to serious environmental destruction, widespread hunger and massive death tolls.

The debate initially received much attention, but over the years it has become rather sterile. While the economist Julian Simon, a resource optimist stressing the role of human inventiveness, argued that every baby that is born increases the likelihood that the world will see another Michelangelo, Mozart or Einstein (Simon, 1981: 10), the biologist and neo-malthusian pessimist Paul Ehrlich replied that a newborn could just as well be a potential Judas, an Attila the Hun or a Hitler (Ehrlich & Ehrlich, 1996: 84).

More recently, neo-malthusian oriented scholars have argued that as the size of the population exceeds the base of renewable natural resources, violent conflict and war over scarce resources can break out. Norman Myers argues that people impoverished by population growth and environmental degradation 'become desperate people, all too ready to challenge governments through [...] guerilla groups' (Myers, 1993: 22). The general argument is that population growth leads to an intensified use of renewable natural resources such as soil and freshwater, eventually leading to a decrease both in the quality and quantity of such resources. And if living conditions for a large number of people depend on the availability of natural resources that are getting low in supply, people will experience deteriorating living standards. This causes grievances among people that under certain conditions can turn into violent conflicts between groups over the exploitation of limited resources. Thus, the neo-malthusian conflict scenario is often referred to as a *grievance perspective*.

Violent conflicts between two or more states are relatively seldom explained by population pressure and scarcity of renewable natural resources.[3] The incident that is most often mentioned as an example of population-induced interstate conflict is the 'Soccer War' between El Salvador and Honduras in 1969 (Renner, 1996: 106–107). The underlying cause is said to be migration of marginalized Salvadoran peasants into Honduras, while the triggering event was a soccer game. But neo-malthusian factors have attracted more attention as potential underlying causes of internal armed conflict. An often cited, although disputed, example is the Rwandan genocide. In one of the most authoritative accounts of the Rwandan civil war, Gérard Prunier argues that 'the genocidal violence of the spring of 1994 can be partly attributed to [...] population density' (1995: 4).

But attempts to foresee future development is a more prominent feature of much of the neo-malthusian literature than explaining historical cases. In 1968, Paul Ehrlich stated that '[t]he battle to feed humanity is over. In the course of the 1970s the world will experience starvation of tragic proportions - hundreds of millions of people

[3] Although shared freshwater resources are frequently referred to as an underlying cause of conflict, especially in the Middle East. Empirical evidence for such a relationship is however relatively weak (Toset et al., 2000).

will starve to death' (Ehrlich, 1968: xi). This proved to be wrong, but much like the messenger boy in Samuel Becket's *Waiting for Godot* who tells the awaiting lot that 'Mr. Godot told me to tell you he won't come this evening but surely tomorrow', the Ehrlichs now argue that there is no reason to expect the danger to be over, as:

> Warning signs that the human enterprise is nearing the end of exponential growth include declines in the amount or availability of good farmland, soil, freshwater, and biodiversity, all of which are crucial elements of natural capital essential for sustaining humanity, and especially for sustaining agricultural growth (Ehrlich & Ehrlich, 1996: 68).

The focus on potential future resource wars rather than actual has been criticized for not being testable (Gleditsch, 2001a), and some of the most notoriously pessimistic contributors have rightfully been characterized as 'doomsayers'. As the predictions that population-induced resource scarcity can cause violent conflict have such a long history, I assume that they do not just apply to the future, but also to the past. There, they should be expected to stand up to empirical testing.

2.1.1 Cornucopian Objections

The neo-malthusian view that population pressure and resource scarcity can cause conflict is met by counter-arguments on several grounds from a research tradition often referred to as cornucopians, resource optimists. Believing that the world is continuously improving by both human and environmental standards, cornucopians offer three main challenges to the neo-malthusian models. First, they claim that resources are not generally scarce and that we are not going to experience a major resource crisis even in the face of continued population growth. Second, if some resources are getting scarcer, humankind is able to adapt to these challenges. And third, it is the availability and abundance of lootable natural resources that causes conflict, and not scarcity.

Objection 1: Resources are not Generally Scarce

One of the first to question the environmental pessimists of the 1970s was Julian Simon. He claimed that the many 'alarmist' environmental concerns were not supported by empirical evidence, that living conditions on a world basis were steadily improving despite strong population growth, that there were no signs of serious environmental degradation and that resources did not seem to become scarcer (Myers & Simon, 1994). While much of the attention in the beginning of the resource scarcity debate centered around mineral wealth and other non-renewable resources, the focus has more recently returned to the original Malthusian concern over renewable resources.

The traditional malthusian concern is that food production will not keep up with the growth in population size. Claims that this is what is happening today (Ehrlich & Ehrlich, 1996) are countered by Tim Dyson (1999). He argues that an extrapolation of recent trends of cereal production should be sufficient to cover the increased world demand for food following from population growth at least until 2025. There are however regional differences. The major exception to the optimistic picture is Sub-Saharan Africa for which expected food production is lower than expected demand. Dyson predicts a major expansion of food trade and aid to compensate for regional variations.

The high-profile cornucopian Bjørn Lomborg (2001) argues that the bad news about the world's development far outstrip the good news in the public opinion - for no good reason. Presenting substantial statistical evidence, he sets out to prove that widespread environmental concerns over food, forest, energy and water are groundless. Lomborg's book caused a heated and polarized international debate.[4] However, opponents of Lomborg tend to agree with him that there is no global resource crisis going on. They claim rather that he understates the potential scarcity of particular resources and especially the seriousness of resource scarcity to less developed countries.

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[4] For an own web page devoted to anti-Lomborg material, see www.anti-lomborg.com. For a collection of some leading environmental scientists' critique of Lomborg, see *Scientific American* 286 (1), 2002.

Objection 2: We Can Adapt to Scarcities

A point related to the above is that if some resources should be limited in supply, humanity will be able to adapt to this. If market mechanisms function satisfactorily, the use of resources in limited supply will be regulated by price mechanisms. This is especially relevant for minerals and other resources, like energy, where it is possible to substitute one source for another. But Lomborg (2001: 156) believes that a wider use of pricing of water could also lead to more effective use of a resource that is in relative scarcity in many localities.

Linked to the argument of pricing, technological development is central to the argument of adaptation. Ester Boserup argues that population pressure on natural resources is the key to development and implementation of new techniques in agricultural production (Boserup & Schultz, 1990). The higher population density relative to the resource base, the more are societies forced to take new technology into use. Historically, already known technology has not been implemented until an area has reached a certain level of population density. The relatively low agricultural effectiveness of many African states is explained by the continent's low population density (Boserup & Schultz, 1990). To Boserup, population growth is neither positive nor negative, it is just something societies adapt to through more efficient production to keep up the living standards. Simon (1989) is more explicit on the positive role of high population growth, believing that this sparks a higher level of economic productivity than that experienced by societies with low population growth. He argues that population pressure on resources generates technological innovation that makes scarcity an ever diminishing problem and creates economic growth. Simon takes this argument even further to infer that increases in population can actually end wars as population-induced economic growth makes it less attractive for states to go to war.

Finally, some scholars have questioned whether it is desirable to try to reverse certain processes of renewable resource degradation if the expected cost is too high relative to the potential gain. Lomborg (2001) argues that both the loss of biodiversity and possible global warming could fall within this category. While recognizing the difficulties measuring the real cost of such environmental change, he suggests that it

could be far more expensive to do something to reverse these processes rather than just adapting to a permanently changed environment.

Objection 3: Abundance, Rather than Scarcity, Causes Conflict

More recently, a group of scholars have suggested a very different causality between resources and regime instability and violent conflict. Paul Collier (2000) claims that rebel groups are likely to have economic agendas, although seldom explicit, implicating that conflict is far more likely to be caused by economic opportunities than by scarcities. Civil war is likely to be caused by groups challenging weak central governments over the access to and revenues from lootable resources. This perspective is especially relevant to non-renewable resources, and especially minerals such as gems and oil, but also potentially applies to products from renewable resources such as drugs, tropical timber and cash-crops.

In a recent study Indra de Soysa (2000) tests both the perspectives of greed-motivated and of grievance-driven civil wars. He finds that an abundance of mineral wealth is positively and significantly related to armed conflict. The more general argument of both Collier and de Soysa is that resource-rich countries also have a higher probability of conflict than resource-poor ones due to what is called the 'resource curse' (de Soysa, 2000: 120). Countries with an abundance of natural resources become dependent on these resources and fail to innovate, causing a slower economic growth than resource-poor countries.

The greed and grievance perspectives are usually presented as competing scenarios, but this can be questioned. The two perspectives are more likely to be supplementary, explaining somewhat different phenomena. The debate nevertheless illustrates that the causality between resources and conflict is not straightforward and simple. Le Billon (2001: 562) argues that lootable resources have become a more important way of financing civil wars after the end of the cold war and the drying up of super-power financial support. He states that greed-motivated wars have become more frequent over the last decade, but makes a very small point out of the fact that most of these are old conflicts financed by new means. However, he does admit that 'few wars are initially motivated by conflict over the control of resources' (Le Billon 2001: 580).

I believe that the greed perspective may be more important for explaining continuation of armed conflict than explaining onset of conflict.

2.1.2 Homer-Dixon: The Moderate Neo-Malthusian Position

Even the most arch-typical cornucopian would not argue that resource scarcities never occur or matter. Natural resources essential to human life and welfare are unevenly distributed between and within states, and this may pose a threat to the lives of a large number of people. Similarly, even the most pessimist neo-malthusian would not argue that resource scarcities would always produce widespread suffering and violent conflict. Not all cases of severe environmental degradation result in violent conflict. Scarcities can be overcome, and even though such scarcities should produce serious grievances they do not automatically lead to armed conflict. Furthermore, not all armed conflicts occur under conditions of strained natural resources. Resource scarcity is thus neither a necessary nor a sufficient factor for internal armed conflict to erupt.

In the following sections, I will present the main theoretical framework of one of the most influential neo-malthusian scholars, Thomas Homer-Dixon. Homer-Dixon has been a main contributor to the environmental security debate, and his works have attracted a lot of attention from policymakers. His projects at the University of Toronto have produced a number of case studies investigating the role of population and environmental factors for a number of conflicts. Based on the works of Homer-Dixon and associates as well as related works, I will discuss the conditions for the neo-malthusian prediction that population pressure produces resource scarcities that erupt into violent conflict.

Like other neo-malthusian scholars, population variables are also central to Thomas Homer-Dixon and the EPS project. He sees population pressure closely linked to the potential scarcity of renewable resources. While he argues that resource scarcities can cause violent intrastate conflict under unfavorable conditions, he believes that such scarcities are less likely to cause interstate conflict. Homer-Dixon somewhat confusingly uses the term environmental scarcity about resource scarcity. I prefer the latter term and will attempt to use that throughout in order to try to separate scarcity of

resources from the processes of environmental change that are assumed to cause such scarcities.

2.1.3 When is a Resource Scarce?

Homer-Dixon and associates distinguish between three main sources of resource scarcity (Homer-Dixon & Blitt, 1998: 6) (see Figure 2.1). *Supply-induced scarcity* results from degradation or depletion of natural resources. It simply becomes less of a resource as a result of non-sustainable use that does not allow the resource to regenerate.[5] In some cases this process go so far that a resource can become irreversibly and permanently degraded even though the human activities that caused degradation are halted. *Demand-induced scarcity* is primarily caused by population growth.[6] If a resource base is constant, the availability of resources per person will diminish with an increasing number of persons that have to share it. Such scarcity can also arise from an increase in demand per capita. A third form is *structural scarcity*. This is a form of scarcity that only applies to certain groups that, relative to other groups, are excluded from equal access to particular resources. Such unequal social distribution of a resource does not presuppose actual scarcity if the resource was distributed evenly. The sources of environmental scarcity are illustrated in Figure 2.1 below.

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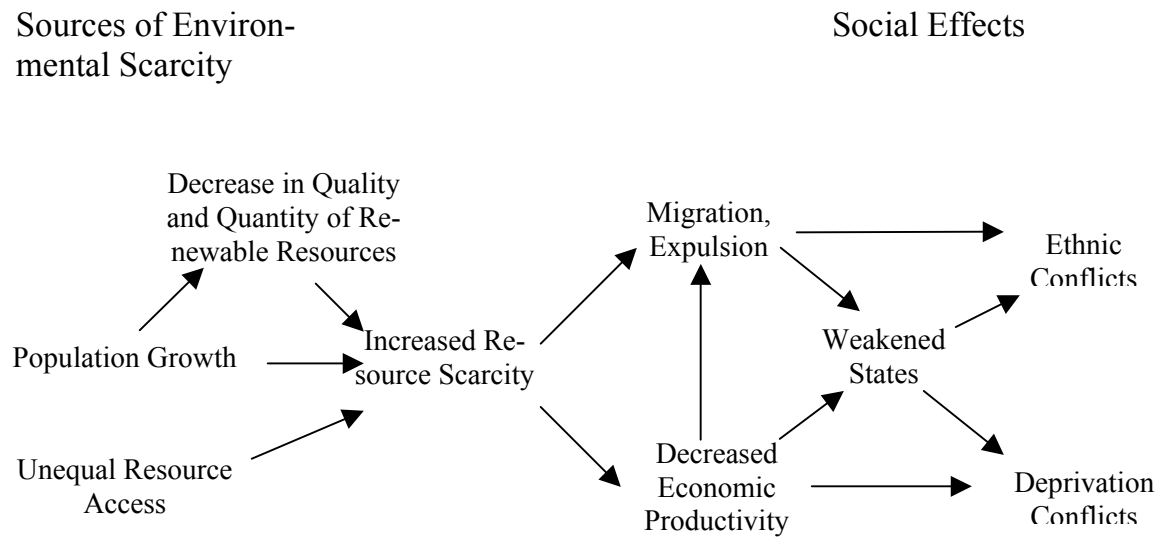
[5] Homer-Dixon focuses mainly on degradation of natural resources resulting from human activity. But natural resources can be both degraded and depleted from causes other than human activity, such as natural disasters or less dramatic natural variation.

[6] Homer-Dixon is unclear with regard to demographic concepts. In one of his first articles on the subject he argues that 'population size and growth are key variables producing the syndrome of environmental scarcity' (Homer-Dixon 1991: 102). The size of the population is however irrelevant as long as it does not relate to the resource base on which the population survives. In the following I will use the term population growth to describe how demographic change can increase the demand for natural resources. I will return to the distinction between population growth and density in Section 2.1.7.

Figure 2.1 *Some Sources and Consequences of Environmental Scarcity*



Source: Modified version of the model in Homer-Dixon (1994: 31).

One of Thomas Homer-Dixon's strengths, and one of the reasons why he has attracted so much attention, is that he presents his notion of environmental scarcity in a very simple and intuitively appealing way. A prime example is his presentation of environmental resources in the metaphor of pies. Homer-Dixon and associates argue that there are three ways that a resource pie can become too small for people to survive on (Homer-Dixon & Blitt, 1998: 6). First, if a resource is qualitatively degraded or quantitatively depleted, this reduces the total size of the pie. Second, when the number of people sharing the pie grows, each share of the pie gets smaller. And finally, if the pie is distributed into unequal sizes, some pieces may be too small for people to survive on. The centrality of the population factor to resource scarcity is obvious. It is the number of people expecting to have part of the pie that decides the degree of scarcity. If a resource is not in demand at all, there is no scarcity by definition.

I believe that Homer-Dixon's very simplistic model and the rather strict categorization of different sources of scarcity does not pay enough attention to the very complex interaction patterns between the three types of scarcity, and especially those between population growth and resource degradation. In Figure 2.1 I have added an arrow from population growth to decrease of renewable resources that is not found in

Homer-Dixon's original model. I assume that population growth can lead to overexploitation of renewable natural resources, that eventually causes lower return as resources are degraded. For instance an increasing population in an area with a fixed amount of cultivable land may experience that it is possible to intensify agricultural production for a long time, but that at some point the soil is too exhausted to produce sufficient amounts of food. Of course, this relationship is influenced by the availability of technology and knowledge to the population in question. Population growth can go along with sustainability if a diminishing share of resources per person is compensated through a supply in technology and knowledge.

Resource distribution, or structural scarcity, may influence whether population growth causes resource degradation. If resources are unequally distributed, this can force a poor and fast growing population to over-exploit the renewable natural resources available to them. Since a poor population is unlikely to have the means, neither in the form of technology nor education, to alleviate the pressure on natural resources, degradation in the quality and quantity of the resource in question is a likely scenario.

However, structural scarcity in itself should not be viewed as a potential source of resource scarcity, but rather as a potential source of distributional conflict. Structural scarcity says nothing about the availability of resources per capita, only about asymmetrical power relations between persons or groups of people that empower someone to capture more than their fair share of the pie. Homer-Dixon and associates have recently replied to the critique that the inclusion of distributional issues makes their concept of environmental scarcity too broad since they could risk classifying a violent conflict that is solely a distributional conflict as environmental conflict (Schwartz, Deligiannis & Homer-Dixon, 2000: 80). In this reply they claim that 'uneven distribution never acts on its own: its impact is always a function of its interaction with resource supply and demand' (Schwartz, Deligiannis & Homer-Dixon, 2000: 80). This is an important specification, and limitation, of the role of structural scarcity that Homer-Dixon and associates previously have undercommunicated in their model of causes and consequences of environmental scarcities (Figure 2.1).

The pie metaphor presented above can further illustrate how the issue of scarcity has become the most contended between neo-malthusians and cornucopians. To cornucopians scarcity exists by definition when a resource is not in infinite and unconditional supply, but they refuse to see resources as pies of a fixed size. They give primacy to the human ability to overcome resource scarcity through technology and knowledge. The level of technology influences the size of the pie, in the case of fresh water it both determines the quantity that can be extracted from the ground *and* the ability to purify polluted water. Thus, high elasticity without any absolute limitation is assumed to exist for the supply of many natural resources. But technology also determines the size of the pie that each individual needs, through for instance water-saving measures. This causes elasticity in demand, deflating the effect of an increasing population. Furthermore, pies can be traded for other pies. In some cases one resource can be substituted for another. Also, since most scarcities are local rather than universal, areas can trade a type of pie that is locally abundant for another pie that is locally scarce (Gleditsch, 2001a: 253), thereby benefiting from comparative advantages.

Cornucopians probably have a better case against those neo-malthusians who argue on a more general basis that we are facing a global environmental crisis because the overall capacity of the world's ecosystem is stretched beyond its capacity. Homer-Dixon and associates are careful not to promote such a 'global' view. They argue rather that local resource scarcities arise and persist because market mechanisms and technological development rather often fail to work locally in many developing countries. A logical inference stemming from this line of argument is that scarcity can be seen as a result of social inability to utilize the full potential of natural resources. It is not very controversial to argue that resource scarcity can arise locally. More important for me is to ask under what conditions resource scarcity may arise and how such scarcity can increase the risk of armed conflict. This will be discussed in Sections 2.1.5 and 2.1.6, but first I will present types of potentially contested resources.

2.1.4 Types of Contested Resources

Most armed conflicts and wars are over objectives that can broadly be defined as resources (Gleditsch, 2001a: 252). Neo-malthusians are primarily concerned with resources that are linked to food production. Homer-Dixon and Blitt argue that large populations in many developing countries are highly dependent on four key resources that are especially crucial to food production: freshwater, cropland, forests and fisheries. The availability of these resources determines people's day-to-day well-being, and scarcity of such resources can under certain conditions cause violent conflict (1998: 2).

The availability of water is central for purposes of both agricultural and industrial production. In addition, water is used for drinking and personal hygiene. The per capita supply of freshwater is varying significantly around the world, and many regions, particularly the Middle East and most parts of Africa, experience that ground water reservoirs are being depleted as a consequence of over-use (Falkenmark, 1990). In many areas, population growth 'consumes the water potential still available to meet an increasing water demand' for industrial and agricultural purposes (Falkenmark, 1990: 86), hindering both economic development and increased agricultural output. It is estimated that about one-third of the world's population is currently living under moderate or severe water stress (World Bank, 1999b: 28).

Cropland is also central to food production, but it is contested whether it is scarce. Some estimates indicate that less than half of the world's potential cropland is actually cultivated, but Homer-Dixon & Blitt (1998: 3) argue that these numbers include land that is either too marginal for cropping or is today under forest cover. Boserup (1981: 16–17) argues on the other hand that much unproductive land is actually part of long-fallow systems, and that marginal land can be transformed into productive areas by the use of fertilizers and irrigation. Earlier claims that population pressure was about to cause irreversible large-scale erosion and desertification is today largely discredited. Annual rainfall and other natural processes have proven to be far more important than human activity in explaining the variation in the extent of the Sahara (Pearce, 2001). And although the last two centuries have seen a net loss of topsoil, the picture is more complex with some areas gaining and some losing (Lomborg, 2001:

105). The total losses are not very dramatic, and the effect of erosion on agricultural production is believed to be relatively limited.

Depletion of forests is believed to influence agricultural production more indirectly. The argument is that population growth causes deforestation through cultivation of new land and search for firewood, and that this contributes to soil erosion (Homer-Dixon & Blitt, 1998: 4). Furthermore, deforestation increases the risk of flooding that can lead to large damages to harvests. There is however little evidence of serious global deforestation. The world's over all forest cover has changed marginally over the past 50 years (Lomborg, 2001: 111), although aggregate figures may mask local variation. The fourth resource believed to be of great importance is fisheries. Fisheries are food suppliers that are important supplements to agricultural production in many areas, and are suffering from local overexploitation (Homer-Dixon & Blitt, 1998: 4).

Homer-Dixon & Blitt (1998: 2–5) believe that global warming and depletion of the ozone layer are unlikely to have a major effect on people's well-being in the near future, and that these environmental concerns are not likely to be immediate causes of violent conflict. The two issues deserve attention, however, ' because when they do eventually have an impact, they will probably interact with already present environmental and demographic pressures, thus making those pressures much worse' (Homer-Dixon & Blitt, 1998: 2–3). By mentioning these two environmental problems along with changes in the supply of their four key resources, Homer-Dixon and Blitt illustrate their conceptual difficulties. Global warming and ozone depletion are not issues of resource scarcity by themselves, but influence the availability of natural resources. Gleditsch (2001b: 55) points out that in the Homer-Dixon model 'any form of environmental degradation can be translated into a problem of resource supply' and that 'one consequence of such a view is that all environmental problems can be interpreted as resource problems, but not vice versa'. When they apply resource scarcity as the main explanatory variable for violent conflict, Homer-Dixon and associates should make a stronger effort to analytically separate resource scarcity from the environmental problems that cause this scarcity.

2.1.5 Conditions for Adaptation

One of the most pronounced arguments made by cornucopians is that we are able to adapt to resource scarcity. They believe that human beings are more likely to invent ways to avoid and get around resource scarcity than to fight over the little there is. A pressure on resources makes it more likely that already existing technology is taken into use, but it also sparks innovation and production of new technology.

Thomas Homer-Dixon (1995) agrees with some of the premises of this cornucopian argument, and acknowledges that the human ability to generate ideas, what he terms 'ingenuity', is the crucial factor for overcoming resource scarcity. But he holds a more pessimistic view than the cornucopians, stressing that many societies, especially in poor countries, are in limited supply of ingenuity. While most neo-malthusians focus on the absolute physical limits to growth in a society, Homer-Dixon is more concerned about those societies that are 'locked into a race between a rising requirement for ingenuity and their capacity to supply it' (1995: 105). As the supply of ingenuity gets shorter relative to resource scarcity, societies will eventually experience a 'critical ingenuity gap'. This raises social dissatisfaction to increase the risk of violent conflict.

There are three factors that especially limit the supply of ingenuity in poor countries. First, market mechanisms that are supposed to increase the supply of ingenuity as resources get scarcer, often fail to work properly. This is both because many renewable resources are common goods and thus difficult to divide into salable and 'priceable' units, and because the use, and overuse, of many resources produce hidden costs through 'negative externalities'. For instance river siltation can be a result of upstream deforestation. Poor countries are more likely to experience market failures than more developed countries because many of them have underdeveloped economic institutions that are ill-suited to deal with such complex price settings (Homer-Dixon, 1995: 598–599).

The second factor is social friction. This phenomenon arises with the existence of 'narrow distributional coalitions' that are able to attract a large share of the resources for the use of their members only. Such coalitions are more interested in securing resources for themselves than to enable society as a whole to increase the availabil-

ity of resources. This prevents the development of new and reformed institutions that could help generate innovation in a society. Again, influential small coalitions are systematically present in unstable countries, which are often also poor countries. Stability is a precondition for the establishment of large coalitions that could overcome narrow self-interests (Homer-Dixon, 1995: 600).

Finally, shortages of financial and human capital reduce the supply of ingenuity in many poor countries. Lack of financial capital reduces the ability for a government to provide public goods such as infrastructure, limiting the possibilities for private entrepreneurs. Furthermore, many poor countries lack the human capital necessary to increase the supply of ingenuity, both because of lack of means to finance large scale education and because many well-educated people in poor countries are leaving for higher income possibilities in developed countries, a phenomenon known as brain drain (Homer-Dixon, 1995: 602–603).

Homer-Dixon admits that the main weakness of the ingenuity approach is the current inability among researchers to quantitatively measure ingenuity, and thereby predict where and when critical ingenuity gaps will appear (Homer-Dixon, 1995: 589). This also implies that it is impossible to empirically verify post facto whether it is the lack of ingenuity that is the reason why some countries experience resource scarcity.

2.1.6 Causal Pathways from Scarcity to Conflict

Thomas Homer-Dixon predicts that increased environmental scarcity is likely to cause social effects that increase the likelihood of internal violent conflict (see Figure 2.1). Environmental scarcities can lead to constrained agricultural and economic productivity causing widespread poverty.[7] Migration can occur either because the environmental quality of their habitat has become unlivable (push factors) or, more commonly, be-

[7] High population growth can strain economic development through other mechanisms than environmental scarcity. If the dependency burden is high, meaning that the number of non-producers in a population is great relative to the number of producers, a larger share of the economic outcome is spent on consumption rather than reinvestment. This can potentially lead to reduced economic growth. Analyzing cross-country data over three decades, Kelley & Schmidt (1995) found that there was a negative impact of population growth on economic development in the 1980s, while this relationship was non-significant for the 1960s and 1970s.

cause the migrants' economic outcome is likely to be better in areas with greater resource availability (pull factors). Both constrained productivity and migration are factors that are likely to strengthen the segmentation around already existing religious, class, ethnic or linguistic cleavages in a society. Increased competition and tensions among such segments reduces the interaction between them, and makes non-violent articulations of interest less likely.

Acknowledging that objective deprivation, the mere fact that people are poor, seldom produces strong grievances, Homer-Dixon relies on the theory of 'relative deprivation' (Gurr, 1970). Individuals and groups can experience relative deprivation when they perceive a gap between the situation they believe they deserve and the situation that they have actually achieved. But the deprivation hypothesis significantly overpredicts the likelihood that violent conflict occurs from grievance, and is thus not sufficient to explain the incidence of such an event (Kahl, 1998: 83). For grievances to erupt into violent conflict, Homer-Dixon & Blitt assume that two other factors need to be present (1998: 11). First, the aggrieved individuals need to participate in some sort of collective that is capable of violent collective action against the authorities. Second, the political structure must fail to give these groups the opportunity to peacefully express their grievances at the same time as it offers them the openings for violent action.

According to Kahl (1998: 83) there are significant collective-action problems that need to be overcome for grievances to be the source of violent conflict. There are strong incentives for individuals to 'free ride' by not participating in the violence themselves, because of the high potential cost of lost income and perhaps even one's own life. Homer-Dixon & Blitt acknowledge these problems and argue that the presence of strong collective identities such as ethnicity, religion and class, are prerequisites for grievance-driven collective violent action (1998: 11). People must also feel the relevance of their group identity for their grievances, that they are aggrieved as a group.

The second contextual factor that Homer-Dixon & Blitt believe to be of great importance is the type of political regime. If the political and economic structures fail to give groups opportunities to raise demands peacefully, it becomes more rational to react violently to grievances. The likelihood that such violence shall succeed depends

largely on the strength of the state. A state characterized by notorious instability and disintegration, a feature often referred to as *state weakness*, is more likely to offer opportunities for violence than a stark and authoritarian state (Goldstone, 2001; Homer-Dixon & Blitt, 1998). Homer-Dixon & Blitt (1998: 11) argue that resource scarcity may also cause state weakness as such scarcity can lead to 'corruption, falling revenues, rising demands for services, or factional conflicts among elites'.

Homer-Dixon & Blitt predicts that one consequence of resource scarcity is migration, which again is likely to produce violent ethnic conflict (Homer-Dixon & Blitt, 1998: 9–10). The ways that refugees can increase the likelihood of violent conflict is similar to the ways through which population pressure in general is believed to influence conflict proneness. What is different is that refugee movements can put a sudden and serious strain on resources in the area of arrival at the same time as refugees seldom have the same moral claim on assistance from the government as the local population. This is especially true for transboundary migration. Furthermore, refugees are often impoverished, and thus lacking the resources to make effective demands on the host community.

Suhrke (1997) notes that refugees are not necessarily a source of conflict. The result could very well be the opposite. Refugees are often incorporated in society and contribute to increased productivity and economic prosperity, often through an ethnic division of labor causing interdependence. One possibility is that this takes the form of systematic exploitation of the refugees. Suhrke does admit, however, that the integration perspective is more relevant to gradual migration processes than sudden refugee movements (1997: 263). While the most striking characteristics of refugee populations in general are their powerlessness and their poverty, conflict and social strife is likely 'if displacement becomes long-term, and if the victims acquire autonomy or powerful allies that enable them to overcome powerlessness and make demands on their hosts' (1997: 263). While such empowerment can be the result of state intervention (Suhrke, 1997: 269), the degree of state weakness will also here matter to the opportunities for violence.

2.1.7 Indicators of Neo-Malthusian Population Pressure

I am unable to test every step of Homer-Dixon's model empirically in the research design applied here. What I aim to do is to identify valid indicators of population pressure that I believe are likely to be potential causes of resource scarcity. I then assume that when population pressure is high, countries are more likely to experience resource scarcity than when population pressure is low, all other things being equal.[8] I further assume that resource scarcity generally produces grievances among the affected population. These two steps are general assumptions in the theoretical framework of Thomas Homer-Dixon, and I believe that I do not have to be able to observe these causal mechanisms directly in order to investigate whether population pressure influences the risk of armed conflict.

The other two factors that Homer-Dixon argues are prerequisites for resource scarcity to be the cause of conflict, social segmentation and weak states, are factors that are believed to be important for armed conflict regardless of the root cause. These are 'filters' that decide whether any grievances will be articulated through violent action. Some degree of social segmentation exist in all societies, as ethnic, religious, class, geographic or even kinship affiliations. According to Homer-Dixon, any kind of social segmentation will do, and I do not attempt to actually control for this. I do however attempt to control for state weakness through a separate regime variable. This will be further described in Chapter 4. In the rest of this section I will discuss indicators of population pressure.

Population Growth

The traditional malthusian focus has been on *population growth*. The concern has been that high population growth would outstrip growth in revenues from natural resources. Population would then eventually exceed the productive capacity of natural resources,

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[8] The assumption that all other things are equal is of great importance here. It implies for instance that I do not attempt to empirically test whether a high supply of ingenuity make societies able to avoid resource scarcity. But as Homer-Dixon admits himself, the level of ingenuity is an aspect of societies that is not measurable. However, since Homer-Dixon argues that lack of ingenuity is mainly a problem in developing countries I will test his ingenuity hypothesis indirectly through an interaction effect between population pressure variables and level of development.

a situation often referred to as overpopulation. Like Malthus, Thomas Homer-Dixon also analytically separates the two elements of the population-resource nexus. In his model, population growth is one side of the equation, the demand side. Continued population growth simply means that an ever-increasing number of people have to share the resources that are available.

But population growth is a dynamic measure that says nothing about the population-resource ratio, only that given a static supply of resources every person gets less. This reduces the validity of the measure as an indicator of population pressure, since countries with high population growth may very well have a plethora of available resources making population increase possible, and maybe even desirable. On the other hand, population growth is strongly related to population density. Given a certain level of density, countries with the highest population growth will be the countries to experience the highest density in the future. If one then assumes a given level of population density, the countries with the highest population growth rates will be the first ones to experience shortages of natural resources, if technology and knowledge is evenly distributed. I thus assume that

> Hypothesis 1: Countries with a high population growth are more likely to experience domestic armed conflict than countries with low population growth.

Population Density

Another measure that is often seen as an indicator of population pressure is *population density*. But when advancing this measure one is no longer exclusively talking about a demand side factor. Population density is a combination of both supply and demand side factors, measuring people relative to area. But population density is a static measure, and I assume that countries that have experienced a relatively high and stable population density over some time are likely to have found ways to cope with it. Thus, population density in itself says nothing about the acuteness of the situation, whether a society has recently experienced that resources have become scarcer. Homer-Dixon believes that neo-malthusian grievances are produced in a dynamic process, where people experience that their living conditions are worsened. Since population density

does not capture this dynamic process, the validity of this measure as an indicator of population pressure is reduced.

An additional shortcoming of this measure is that the conventional definition, the number of people per square kilometer in a country, says very little about the ratio between population and the resource base. High density is more of a problem in arid areas than in fertile ones. Partly on these grounds, Ehrlich & Ehrlich (1996: 70) criticize the use of population density as a measure of population pressure calling it the 'Netherlands fallacy'. If density instead is measured as population relative to the area that potentially could be used for food production, what I term *arable* land, one is able to measure the population pressure relative to the perhaps single most important renewable natural resource, although this ignores the role of international food trade. While there are a few examples of large-N studies of armed conflict that have included population density among the independent variables, none of these have attempted to measure the total population relative to arable land.

Despite the limitations of the population density measure discussed above, I assume that countries with low population density are less likely to have ever experienced a serious pressure on natural resources, and are thus in general less likely to experience such a pressure at any given time compared to countries with high population density. I hypothesize that

> Hypothesis 2: Countries with high population density relative to arable land are more likely to experience domestic armed conflict than countries with low density.

Population Growth in the Context of High Density

The two most widely used measures of population pressure thus fill different functions that scholars need to be aware of when applying them in empirical studies. While population density is a static measure controlled for the availability of fertile land, population growth is a dynamic measure that is decoupled from actual resource availability. While none of the measures are very valid indicators of population pressure on their own, I would expect that the coexistence of the two factors, high population

growth in a context of already high population density, would indicate an extraordinary strain on natural resources.

I am surprised that the relationship between population growth and density has been completely neglected in previous large-N studies. While there have been some attempts to test neo-malthusian hypotheses on a larger scale, none have apparently ever tried to investigate whether the interaction of the dynamic and static measures of growth and density is what causes situations of neo-malthusian resource scarcity. This interaction is the most valid indicator of neo-malthusian population pressure that I have been able to identify, and I assume that

> Hypothesis 3: The higher population density relative to arable land a country experiences, the stronger is the conflict-conducive effect of high population growth.

Migration

A third form of population pressure is *migration*. Homer-Dixon is mainly concerned with how migration can be the outcome of resource scarcity. Such migrants, often labeled with the dubious term 'environmental refugees', can set off into new areas as a result of long-term resource degradation or more sudden environmental disruption, a distinction often used to analytically separate migration caused by pull and push factors. Most often, however, environmental change is only one factor working together with factors like political oppression and economic deterioration to cause migration (Trolldalen et al., 1992). Environmental change can be a source to migration, but such links are 'complex, uncertain and difficult to detect' (Suhrke, 1997: 255).

While Homer-Dixon and associates primarily focus on how environmentally induced migration can lead to inter-group ethnic and religious conflict, there is also vast evidence that large groups of migrants can be a source of serious environmental degradation in the receiving area. This is especially the case with large refugee camps (ECHO, 1995: 5). The impact that migrants have on the environment in the receiving area depends on their total number, the degree of concentration and on whether the movement of people is large scale and sudden or small scale and long term.

Migration can thus be seen as a demand side factor. When migration is gradual, it is probably more correct to treat it as a component of population growth, and not as a distinct form of population pressure. But large-scale and sudden influxes of migrants into an area will be treated as a separate analytical category of population pressure, no matter the cause of migration.[9] Such population movements are likely to produce more acute and sudden social and environmental challenges than population growth. This is also a relationship that, to my knowledge, has not yet been tested in any previous large-N study.

Hypothesis 4: Countries that host large refugee populations are more likely to experience domestic armed conflict than countries that do not.

2.2 Population Pressure Beyond Malthus: 'Youth Bulges'

The population-conflict debate has primarily been over neo-malthusian concerns, focusing heavily on demographic macro indicators such as population growth. Surprisingly little attention has been given to other forms of population change that might be strongly associated with political instability (de Sherbinen, 1995). It has been suggested that under certain conditions particular kinds of population change such as urbanization, migration, strong growth in the agrarian population, unequal growth rates between ethnic groups, and changes in the age composition of a population, can spark violent conflict (Goldstone, 2001; Tir & Diehl, 2001). These kinds of population changes do not necessarily affect the likelihood of violent conflict through scarcity of renewable resources, but are linked to issues such as wealth distribution, employment, public services and cultural differences. Goldstone (2001: 100) argues that the risk of conflict increases substantially when specific population changes occur in the context

[9] I choose to focus here on refugee populations. To be termed refugee, a person needs to fill certain criteria defined in the United Nations Refugee Convention. My refugee measure includes only refugees who are recognized by the UNHCR as such, thus including only people who have fled across a border from their country of origin. I assume that large groups of internally displaced people (IDPs) may put an equally strong pressure on natural resources as refugees, but reliable information on IDPs are not available.

of limited economic growth. This causes a population pressure on the absorptive capacity of societal institutions such as educational institutions and the labor market.

Among the specific kinds of population change mentioned above, changes in age composition in the form of 'youth bulges', have received the most attention from scholars. I define youth bulges as a relatively high number of 15–24 year-olds in a society compared to the total adult population (15 years and above). To my knowledge, only two other studies with a similar research design as mine have attempted to test empirically whether youth bulges increase the risk of armed conflict. But as I will argue in Chapter 4, both of these studies have serious shortcomings. Furthermore, I attempt, unlike the previous studies, to investigate whether youth bulges and important contextual factors may work together to influence the risk of conflict. In the next sections I will explore possible links between youth bulges and violent conflict theoretically and attempt to model under what conditions and in what kind of contexts youth bulges can cause armed conflict.

2.2.1 Youth Bulges and Armed Conflict

One of the leading theorists on the role of youth in political violence, Jack A. Goldstone, claims that

> Youth have played a prominent role in political violence throughout recorded history: and the existence of a 'youth bulge' (an unusually high proportion of youths 15–25 relative to the total population) has historically been associated with times of political crisis (Goldstone, 2001: 95).

One of the factors that seems to have triggered the debate about youth bulges and conflict is the rioting of the baby-boom generation (the relatively large cohorts born in the years after the end of World War II) of the US and Western Europe. Jones (1990: 176) believes that the sheer number of baby-boomers is an important factor for explaining conditions like the student unrest of the 1960s and the employment crisis and escalating house prices of the 1970s and 1980s. While none of the episodes of student unrest qualify for the term 'armed conflict', there are other historical events that

support the youth bulge hypothesis. Among the more prominent are the role played by the historically large youth cohorts (caused by the rapid decline in infant mortality some 20 to 30 years earlier) in the French revolution of 1789, and the importance of economic depression hitting the largest German youth cohorts ever in explaining the rise of Nazism in Germany in the 1930s (Moller, 1968: 240–244).

Some theorists have suggested that a generation that undergoes a common unifying experience develops a generational consciousness. This experience may be a military victory or defeat, a shift in the economy and labor markets, or even the mere awareness of belonging to a generation of an extraordinary size and strength (Goldstone, 1999: 4–5). Generational consciousness binds the members of one generation together as they have 'shared the same hopes and disappointments, and experienced a common disillusionment with respect to elder age groups, toward whom their sense of opposition is defined' (Feuer, 1969: 25). A self-conscious generation in opposition to the elders can produce generational conflict.

Generational consciousness may be an important source to identity for young people, and the existence of a strong sense of belonging to a group that share your grievances and/or aspirations can serve as a basis for collective action. However, violent conflict between groups only divided by age are rare. Other dividing factors of a social, economic or geographic character tend to fragment generations. This produces 'generational units' (Braungart, 1984) of people who share the same grievances, and such units are potential spearheads of protest and violent conflict. Goldstone (1999: 6–7) assumes that 'if social and political conditions are such that a majority of the population is at least thinking about rebellion, the dynamics of revolution may be greatly affected by the age-distribution of the population'.

I believe that the generational approach has some serious shortcomings with regard to the explanatory power of the relationship between youth bulges and violence. The development of generational units may explain the formation of youth movements that can function as identity groups. Identity groups are necessary for collective violent action to take place. But it is not necessary that identity groups are generation-based for youth bulges to increase the likelihood of armed conflict. Furthermore, the generational approach does not offer explanations for the motives of youth rebellion nor does

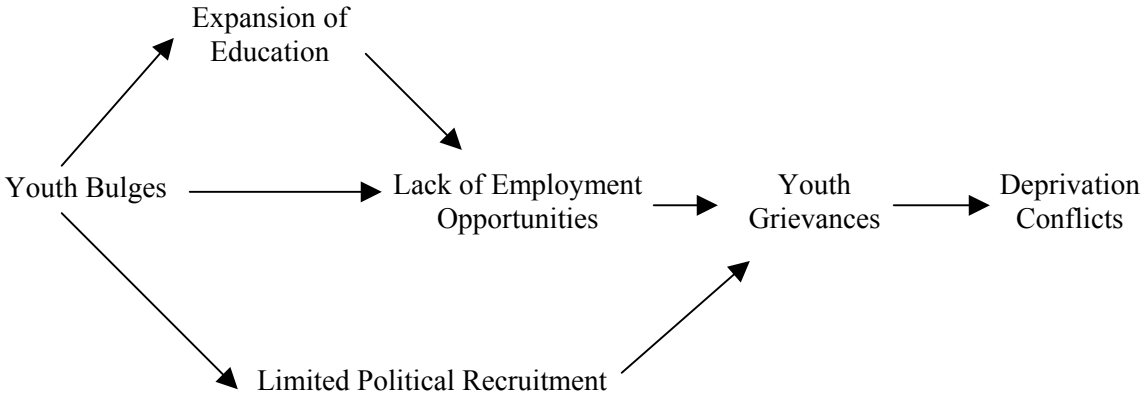
it provide a sufficient explanation for the opportunities of conflict. It is clear that if large youth bulges that hold a common generational consciousness would always produce conflict, we would have seen a lot more of violent youth revolts. Conditions that provide youth bulges with the necessary motives and opportunities for armed conflict will be discussed below. As a general starting point, I assume that:

Hypothesis 5: Countries that experience youth bulges are more likely to experience domestic armed conflict than countries that do not.

2.2.2 Youth Grievances

I have constructed a model for the assumed relationship between youth bulges and armed conflict presented in Figure 2.2. The model assumes that youth bulges are likely to experience unemployment because they increase the supply of labor substantially when entering the labor market. Unemployment is believed to cause grievances, and especially so if expectations are raised through expansions in education. Similarly, grievances arise if possibilities to influence the political system and attain elite positions are limited.

Figure 2.2 *Youth Bulges as a Source of Armed Conflict*



The first interaction effect I wish to address is that of youth bulges and employment opportunities. Generations that are considerably larger than their parents' generations are likely to run into several societal 'bottlenecks', straining social institutions. And most theoretical works concerned with youth bulges point to limited ab-

sorbing capacity of the labor market as the most important factor for causing grievances among youth.

If young people on a greater scale are kept out of the labor market this is likely to cause dissatisfaction and grievance. Unemployment is normally greater among younger than older cohorts in most societies, and youth bulges put an additional strain on the labor market. If the ability in the market to absorb a sudden surplus of young job seekers is limited, a large pool of young unemployed and frustrated people arises. The absorbing capacity of the labor market depends heavily on the degree of diversification and flexibility of the economy. Youth bulges will be especially vulnerable to unemployment if they coincide with periods of serious economic decline, as those entering the labor market most recently usually are the most likely to experience unemployment. Choucri (1974: 73) believes that such coincidences generate despair among young people that moves them towards the use of violence. The belief in the 'system' is eroding:

> Unemployment in any society weakens the political system's legitimacy and stability. Such conditions produce a climate of radicalism particularly among unattached youth who have the least to lose in the gamble and struggle for revolutionary gain (Braungart, 1984: 16).

Focusing less on possible grievances, Paul Collier (2000: 94) assumes that the willingness of young men to join a rebellion depend on their other income-earning opportunities. If young people are left with no alternative but unemployment and poverty, they are likely to join a rebellion as an alternative way of generating an income. For a rebel force to initiate a rebellion Collier assumes that the rebel force must grow rapidly, and that their likelihood to succeed is much smaller if there is a relatively tight labor market (Collier & Hoeffler, 2002a: 6). What Collier holds in common with proponents of the grievance perspective is that unemployment reduces the cost for young people to engage in conflict, which makes it easier to overcome collective action problems. The less opportunities for young people to get a job, the more likely is it that they engage in violent conflict.

Reliable time-series information on employment opportunities, and especially on employment opportunities for youth groups, is not available for a large number of countries, making a direct empirical testing of the relationship between youth bulges, employment and conflict difficult and unreliable. Instead I opt for an indirect testing of this relationship. Since the general economic performance of a country is usually strongly influencing employment opportunities, I assume that:

> Hypothesis 6: The less economic growth a country experiences, the stronger is the conflict-conducive effect of youth bulges.

The way that employment opportunities influence the conflict potential of youth bulges is strongly linked to level of education. Goldstone (2001: 95) argues that a rapid increase in the number of educated youth seems to precede episodes of political upheaval. Well-educated youth have often been observed in central positions in episodes of riots, more recently student groups have entered the streets of Jakarta, Teheran, Belgrade and Harare demanding democratic reforms. One reason why students would want to revolt is if their aspirations of employment and political influence are not met. Choucri speculates that 'the greater the unemployment among the educated youth, the greater are the propensities for dissatisfactions, instability, and violence' (1974: 73). Braungart (1984: 16) observes that

> The underemployment and unemployment prospects for university educated youth in many developing countries, as well as in more advanced developed countries, enlarge the reservoir of latent rebellion from which revolutionary politics can be drawn.

But why should educated youth be more aggrieved by unemployment than uneducated youth? Collier (2000) argues that there is reason to expect that a higher level of education among men rather reduces the risk of conflict, resulting from the higher opportunity cost of rebellion for educated men. Since educated men have better income-earning opportunities than the uneducated, they would have more to loose and would then be less interested in joining a rebellion.

Collier's argument illustrates that the role of education in causing grievance is not straightforward. Collier is right that education increases the value of a person's labor, but it also raises this person's expectation of a relatively high income. This means that educated youth experience a greater gap between expectations and actual outcome if they face unemployment. Kahl (1998: 103) argues that the high expectations among educated urban youth in Kenya caused frustration and anti-state grievance when unemployment hit this group at the end of the 1980s. This illustrates that the opportunity cost of system maintenance is highest for those with high education, making it more rational for educated youth to take part in rebellions than for uneducated youth.

Collier is right, I believe, to argue that a high level of educational attainment in a society generally reduces the risk of conflict. But inflexible developing economies are unlikely to be able to absorb a sudden rapid increase in the number of young academics. So when youth bulges go along with rapid expansions of education this is likely to be a potential for youth grievances. Braungart (1984: 14–15) finds that the most explosive episode of violence in Sri Lanka (1971) happened in a situation with a great increase in youth cohorts in the context of a rapid expansion of education and rising unemployment.[10]

The second interaction I wish to investigate is that of youth bulges and regime type. Regime characteristics may provide the incentives for youth to riot against the government, but this relationship has been largely neglected in theoretical works on youth bulges and conflict. My argument is that autocratic regimes are likely to have a very closed recruitment process both for political and economic positions (which are often intertwined in autocracies), and that this recruitment process is more closed the more autocratic a regime is. Level of education is important also to this argument; I assume that educated youth may generate conflict if their expectations of influence in society and access to elite positions are not met. This may be one explanation for re-

[10] Unfortunately, data on educational attainment is so sparse that this prevents a direct testing of the relationship between youth bulges, level of education and conflict onset in the present analysis. Information on education drawn from the World Development Indicators (World Bank 1999) only covers a very limited part of my dataset. These data shortages also prevent the construction of a variable measuring *expansion* of education in a country.

cent episodes of violence initiated by students in Myanmar, Iran, China and Zimbabwe. This argument is in itself not dependent on the existence of a youth bulge, youth can be deprived of elite positions even though they are relatively few. But if the youth make up a large share of the adult population they are more likely to succeed in causing a violent clash with the government. I thus assume that:

> Hypothesis 7: The less democratic a country is, the stronger is the conflict-conducive effect of youth bulges.

The only scholar that I have seen specifically addressing the role of regime type in interaction with youth bulges is Jack Goldstone. He argues that a rapid increase in educated youth aspiring to elite positions can increase the risk of violent conflict, especially 'in the context of a relatively limited, semi-closed structure of elite positions' (2001: 95). This is not the same expectation as mine, as I interpret Goldstone to expect intermediate regimes, those that are not fully autocratic nor fully democratic, to be most exposed to youth generated conflict. While I will also test for this possible relationship, it is important to note that I separate the interaction effect between regime type and youth bulges from the general filtering effect of state weakness (as presented in Section 2.1.7). The former represents a cause for youth bulges to rebel while the latter is a condition (and control variable) that influences the likelihood that a latent conflict will turn into a violent conflict, no matter what the root cause of the conflict is.

2.2.3 Opportunities for Youth Violence

The underlying main argument why youth bulges create opportunities for violent conflict lies in the sheer number of individuals that make up the bulge. Relative to previous generations, the pool of potential rebels increases. And since large youth cohorts stretch the limits of social institutions such as the labor market, youth bulges in themselves are likely to produce more aggrieved individuals. But as discussed above, the existence of serious grievances is not sufficient for collective violent action to erupt. What can explain how aggrieved youth become rebellious youth?

In general, youth seem to be more available to participation in violent conflict than older people. This has to do with both cultural and structural factors. Samuel P. Huntington (1996: 117) argues that 'young people are the protagonists of protests, instability, reform, and revolution', suggesting that youth generally have a natural urge for change. Also focusing on the troublesome idealism of the young, Goldstone (2001: 95) claims that large youth groups can cause conflict because they are more easily attracted towards new ideas and religions and thereby challenge traditional forms of authority. According to Feuer (1969: 32), students that take part in generational struggles often live in relative material comfort, but are driven by an 'ethical compulsion'.

In addition to being more open to change, young people generally have fewer responsibilities for families and careers and 'are simply free, to a unique degree, of constraints that tend to make activism too time consuming or risky for other groups to engage in' (Goldstone, 1999: 3). In economic terms, the cost of recruiting young people to rebel movements is relatively low since the opportunity cost for a young person generally is low (Collier, 2000: 94). As will be further discussed in Section 3.1.4, demographic literature suggests that this is even more true for many pre-conflict periods. In periods of serious economic decline, that often precede violent conflict, marriage and child bearing tend to be postponed (Lee, 1990). This reduces the responsibilities and increases the availability of young people to engage in violent conflict.

As argued above, a strong collective identity is a precondition for people to act violently in response to grievances. Since I believe that generational consciousness in itself is insufficient as a strong identity marker, other forms of social segmentation need to be present for youth grievances to increase the risk of violent conflict. Some empirical evidence suggest that ethnicity is the form of social segmentation that is most likely to be transformed into a manifest, violent conflict as a result of the existence of youth bulges. Huntington argues that the existence of large youth bulges account for many of the intercivilizational conflicts in the late twentieth century (1996: 261). He holds that the most serious episodes of ethnic violence in Sri Lanka have taken place in periods when the rioting ethnic groups have had their youth bulge peaks (1996: 259–60). Furthermore, Esty et al. (1998: 3) claim that their empirical study shows that the risk of ethnic conflict in a country greatly increases by the presence of a

youth bulge. As argued in detail in Sections 2.1.6 and 2.1.7, the type of political regime, the degree of state weakness, is another important factor determining the possibilities for peaceful action and the openings for violent conflict.

An important, but neglected, way that youth bulges can increase the likelihood of violent conflict, is by 'the demonstration or vanguard effect that a larger youth cohort can provide' (Goldstone, 1999: 6). Goldstone argues that 'studies of collective action have noted that a key ingredient for successful protest is the existence of a core of committed leaders and followers'. He believes that a core of young and risk-willing rebels can provide an effective leadership; '[g]iven the leading role of the young, small changes in the age composition of a population can have a marked effect on popular mobilization' (Goldstone, 1991: 136). I assume that especially collectives of educated youth can bridge the gap between different groups in order to gather sufficient popular support for a successful revolt.

3. Processes of Demographic Change

3.1 Determinants of Population Growth

Increases in population growth can come about as a result of reduced mortality, increased fertility, increased migration, or a combination of the three. Factors that lead to changes in the levels of these proximate determinants of population growth are numerous and diverse, and fall into socio-economic, cultural, ecological, geographical and physiological categories. The more important factors will be discussed in greater detail below.

In pre-industrial and pre-modern Europe, population was more or less stationary, with high rates of mortality and correspondingly high rates of fertility. Population growth was low. Following the age of modernization and industrial revolution, agricultural productivity and sanitary conditions improved, causing mortality declines and strong population growth. The fall in mortality, and especially the sharp decrease in infant mortality, reduced the functional necessity of high fertility. It was no longer necessary for parents to have a high number of children to make sure at least some of them grew up to support them at old age. As the idea of family planning became more legitimate and children became more of an economic burden to their parents partly because of universal education, fertility started to decline. Again population returned to a stationary level, now with low rates of mortality and fertility and little population growth (Jones, 1990: 20).

In many developing countries, fertility is higher and the fall in mortality happened much faster than in nineteen century Europe. Mortality has dropped substantially in many developing countries over the past fifty years following from improved health care systems. As will be argued below, the societal changes that accompanied the industrialization in Europe to cause a lower demand for children have not applied to developing countries to the same degree. Emigration opportunities have also been more limited than for nineteenth century European countries. This has caused a popu-

lation growth in many countries over the past decades that is much greater than was ever the case in Europe, and a growth in world population that is unique in history.

However, the last decade has seen a substantial decrease in fertility in many developing countries, also in Sub-Saharan Africa (Cohen, 1998). Cleland (1993: 234) notes that 'countries that have succeeded most in reducing childhood mortality also tend to record earlier and sharper declines in fertility'. Below I will discuss what factors that contribute to strain fertility in some areas and countries, and what explains continued high fertility and population growth in other.

Processes of migration will not be treated in detail here, although rates of migration are sometimes significant contributors to overall population growth rates. As mentioned earlier, the strong population growth in Europe in the nineteenth century was eased by the emigration to the US. In the period 1840 to 1914, 750,000 persons emigrated from Norway to the US. This corresponds to 40% of the annual natural growth in this period (Jones, 1990: 232).

3.1.1 Mortality

During the period 1940–70 mortality in less developed countries declined substantially. This reduction was partly due to developmental improvements, and partly to medical and public health programs designed to combat epidemic diseases. These programs were provided by colonial powers and international organizations (Jones, 1990: 49). Many countries experienced over a decade declines in mortality that took 150 years to achieve in Europe, but in the beginning of the 1980s, the decline stagnated (Caldwell, 1986: 51). Today high infant and child mortality, under one and five years respectively, are the main reasons why many developing countries do not achieve the same levels of life expectancy as developed countries.

Economic development has often been recognized as the most important road to low mortality, but this is only true to a certain extent. Jones (1990: 28–29) argues that mortality declines with an increase in GDP per capita as long as countries are relatively poor, but the effect diminishes above a certain level of wealth. For higher income countries, the internal distribution of wealth is more important. Furthermore, the

level of economic development is only one of several factors influencing the level of mortality; ‘some countries reach health levels far above those that would be dictated by their economies and others fall far below’ (Caldwell, 1986: 173).

The reasons for high infant mortality in developing countries are under- and malnutrition resulting from poverty, lack of clean and safe water, limited health services especially in rural areas, and a lack of financial means to combat epidemic diseases (Jones, 1990: 52–54). While general economic improvements can alleviate some of these problems, an alternative route to low mortality for poor countries go through factors such as increased female autonomy, and by giving high priority to the provision of health services and education (Caldwell, 1986). Countries that have successfully followed this path include China, Cuba, Sri Lanka and Costa Rica (Cleland, 1993: 234).

3.1.2 Fertility

There is no unifying theory that explains why fertility declines. There are enormous variations between countries that have undergone a fertility transition with regard to demographic, social, and cultural contexts. One precondition that does seem to be universally necessary is a mortality decline. Without a fall in mortality, a fertility decline is highly unlikely (Mason, 1997: 446). Reduced mortality is however seldom a sufficient condition, and fertility decline can occur at many absolute levels of mortality.

It is common to explain fertility decline with processes of social change related to socioeconomic modernization in combination with the availability of family planning programs. Mason (1997: 449) argues that the first country within a geographic/cultural region to undergo a fertility transition is likely to have experienced some kind of cultural, social structural or environmental changes. In nineteenth century Europe, the same processes of social change were associated with both mortality and fertility decline. In most developing countries mortality decline followed largely from the introduction of western modern medicine and was not immediately accompanied by processes of social modernization.

The perhaps single most important socioeconomic factor that influences fertility decisions is the potential economic benefit of children. With the industrialization of Europe, production changed from family-based to capitalist. This, in combination with the introduction of universal education reduced the value of children as producers (Jones, 1990: 103). In societies that have not undergone a fertility transition it is generally not until the number of surviving children exceeds the family's capacity to accommodate them that parents will resort to fertility control (Mason, 1997: 449). In the one region that has not yet experienced a major fertility decline, Sub-Saharan Africa, the positive economic assets still provided by children is one of the main explanations for this (Cohen, 1998: 1445).

Another aspect of socioeconomic modernization that has contributed to fertility decline is the expansion of educational opportunities, especially for women. Female education has proved to be an important determinant of fertility decline over a broad set of contexts and countries, and is also a crucial factor in the recent onset of a fertility decline in Sub-Saharan Africa (Caldwell, Orubuloye & Caldwell, 1992; Cohen, 1998). Jejeebhoy (1995) argues that female education influences fertility through empowerment and autonomy of women. She believes that this increases the knowledge, social status, openness to modern ideas and independence from traditional sources of authority, to allow women to reduce their fertility. Female education is further linked to female labor force participation, another factor that is likely to reduce fertility.

There are also cultural forces in play to determine fertility levels. Generally, cultures differ with regard to the acceptability of family planning influencing the individual cost of fertility reduction. Furthermore, some forms of religious practices, most notably African traditional religions, promote large families. Central to these religions is that ancestor spirits live on exclusively through the rites conducted by descendants, and no surviving descendants mean no life in the hereafter (Caldwell & Caldwell, 1987). The persistence of high fertility in parts of West Africa is partly due to such religious belief (Cohen, 1998: 1445).

For processes of socioeconomic change to result in a fertility decline, modern contraceptives need to be available and taken into use. Economic costs of fertility control can be overcome with the provision of free, far-reaching and effective public

health services and family-planning programs. While family planning programs do not seem to influence the number of children that couples wish to have, such programs 'do help to crystallize latent demand' (Freedman, 1997: 10).

3.2 Age Structure – What Causes Youth Bulges?

The age structure of a population can become skewed in favor of younger cohorts, thus causing youth bulges, in two ways. First and most common, the size of younger cohorts can increase relative to previous ones. Youth bulges are especially associated with what is generally referred to as *demographic transition*. Transition periods are marked by reduced mortality and continued high fertility. Although demographic transition is far from being a globally uniform phenomenon, most countries in the world have over the past two centuries experienced periods of substantial mortality reductions. In most countries, fertility has begun to drop some time after the fall in mortality, and falls in fertility levels are quite recent experiences for many developing countries.

Transition periods are likely to cause youth bulges since falling mortality means that an increasing number of children survive. Since fertility levels continue to be high for a relatively long time after mortality reductions, the total number of young people will be high relative to the sizes of previous generations. Youth bulges can also be caused by extraordinary periods of postponed fertility, like the baby-boom in the US and Western Europe after World War II. Such youth bulges are however small compared to those caused by periods of demographic transition.

Second, in some societies age structure can be skewed in favor of youth cohorts because older cohorts become more than naturally depleted. Especially is this the case with countries that are strongly affected by the HIV/AIDS epidemic. Many countries in Sub-Saharan Africa are now experiencing prevalence rates that will literally wipe out whole generations of adults in the near future. In most of these countries fertility remains high, and in combination this will cause an extreme skewedness in the age structure in the years to come. In some countries, high rates of labor migration can contribute to a depletion of the adult population. Especially island states like Cape

Verde and small Caribbean states have experienced large youth bulges resulting from high emigration rates (see Section 4.5.5).

If the number of people in younger cohorts increases, this can later add a significant contribution to population growth. When cohorts that are considerably larger than their parents' cohorts proceed into the childbearing age groups, population growth will still be strong despite any reductions in fertility rates per woman. This phenomenon is called *demographic momentum*. An illustrative example is China that continues to experience relatively high rates of population growth two decades after the introduction of the one child policy. Fertility rates have recently declined to a level below replacement fertility (although far above one child per woman), but the large cohorts of young people that are the results of previously high fertility will cause continued population growth for still some time.

3.3 The Effects of Crisis and Conflict on Demography

Severe economic crisis and armed conflict are potentially important factors of demographic change through increased mortality and migration, and reduced fertility (Lee, 1990). Even relatively modest economic recession can cause demographic responses, such as the fertility decline in Sweden following the economic setback of the first half of the 1990s. The magnitude of the demographic response is expected to increase with the severity of an economic crisis or an armed conflict.

During times of crises, marital fertility may be reduced because people want to postpone childbearing to times of greater economic security and predictability. To some extent reduced fertility is also achieved through postponement of marriages and through reduced fecundity, the biological ability to conceive, potentially resulting from under- and malnutrition. After the end of a crisis, fertility often rises above normal levels for a period, but it is unlikely that this increase fully catches up the previous fertility loss. Mortality is likely to increase as a result of under- and malnutrition, either because people starve to death or because they are more vulnerable to diseases. Some time after the end of a crisis, mortality often falls below normal level following from the premature deaths of weak and elderly individuals. Lee (1990: 1) argues that

‘mortality has greater responsibility in poorer settings and fertility in richer settings’. Another important response to economic crises is migration. People tend to move to areas where there are jobs or fertile land available, or even to other countries that offer better opportunities.

Empirical evidence for the relationships between economic crises and demographic change are however ambiguous. Surveying literature on the consequences of economic crisis possibly linked to structural adjustment programs in developing countries, Mason (1993: 426) argues that ‘there is no evidence of a widespread decline in childbearing or increase in mortality’.

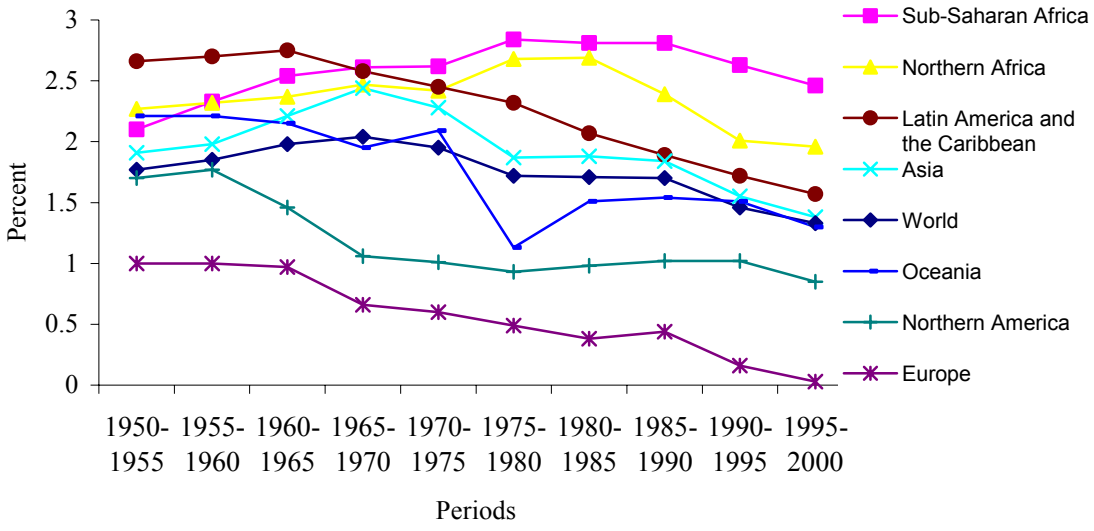
The ways that economic crises influence demographic change are similar to the effects of armed conflict, although conflict can produce even more drastic demographic change, especially through massive migration or expulsion and extensive mortality. Recent and severe examples of both are Bosnia and Rwanda. In a survey of demographic consequences of war, Rasler & Thompson (1992: 256–257) argue that while ‘the demographic influence of war is relatively insignificant insofar as total world population is concerned’, they find that the demographic influence of war increases with the intensity and the proportion of the male population mobilized, that wars produce postwar compensatory birth waves, that deaths caused directly by war are fewer than deaths caused indirectly by war-related disease, epidemics, and famine, and that among civil victims are children, the aged and the unhealthy strongly overrepresented. Further, they conclude that wars make significant dents in the age and sex composition of the population.

Armed conflict can thus have important influences on demographic change, affecting both population growth and the age structure. Following the arguments above, the existence of armed conflict can thus produce demographic changes that again can lead to new or renewed conflict. This is especially serious to societies that have an extensive conflict history.

3.4 Population Trends 1950–2000

The population trends have been diverse in different world regions in the latter half of the twentieth century. Yet, at the end of the century, the trends are pointing more or less in the same direction with lowered population growth, reduced fertility and continuing declines in infant mortality. World population has been growing at annual rates of 1.33 between 1995 and 2000, which are the lowest growth rates for the whole of this fifty-year period (Figure 3.1). Growth rates are at present highest in Sub-Saharan Africa, but even in this area they are starting to decline. In the beginning of the period, Latin America and North Africa saw the highest population growth, but both areas have experienced substantial reductions in growth rates over the last decades.

Figure 3.1 *Annual Population Growth*

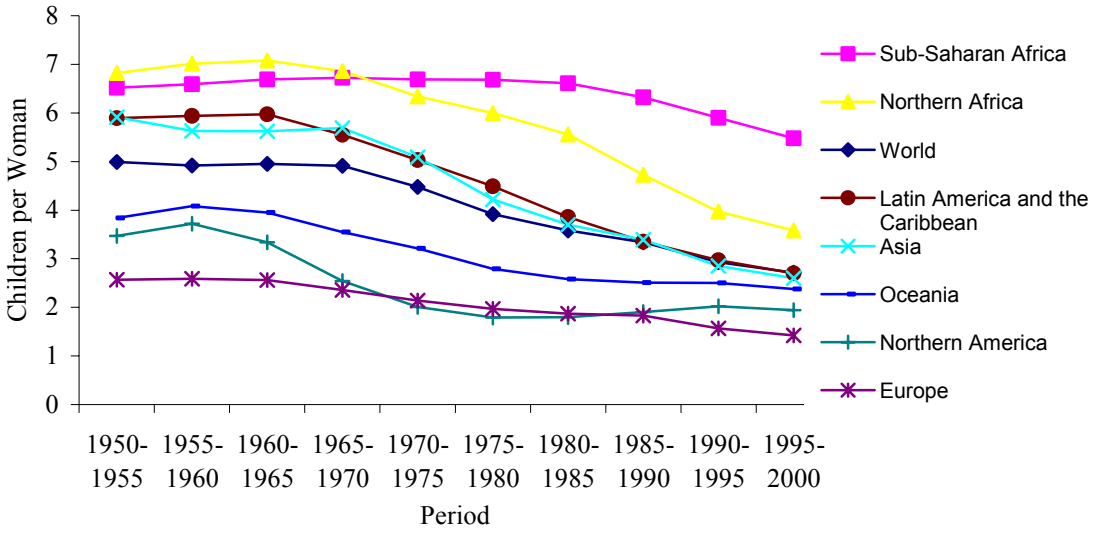


Source: UN (1999).

In Europe, population growth is now almost negligible, only 0.03% annually for the last five year period of the century. Eastern European countries like Hungary, Latvia, Estonia and Bulgaria are already experiencing population decrease. The main reason for this development is the low level of fertility (Figure 3.2). Both North America and Europe have experienced fertility below replacement level all the way since the 1970s. Population has continued to grow in these regions only as a result of high

immigration and continued declines in mortality. Population projections predict negative population growth for Europe for the next 50-year period (UN, 1999). Figure 3.2 shows that fertility levels in the regions of Asia, Latin America and North Africa started to decline in the 1970s, while fertility in Sub-Saharan Africa remained virtually unchanged until mid 1980s.

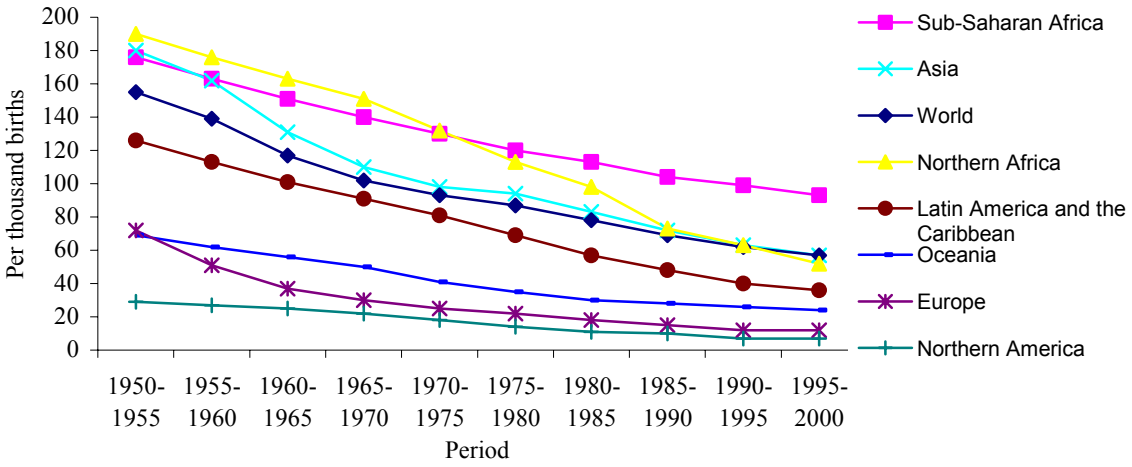
Figure 3.2 *Total Fertility Rates*



Source: UN (1999).

Infant mortality rates have steadily improved in all regions of the world over the past 50 years (Figure 3.3). Sub-Saharan Africa has not experienced such dramatic drops in infant mortality as the other developing regions, and is lagging behind with rates almost the double of the second worst regions of Asia and North Africa.

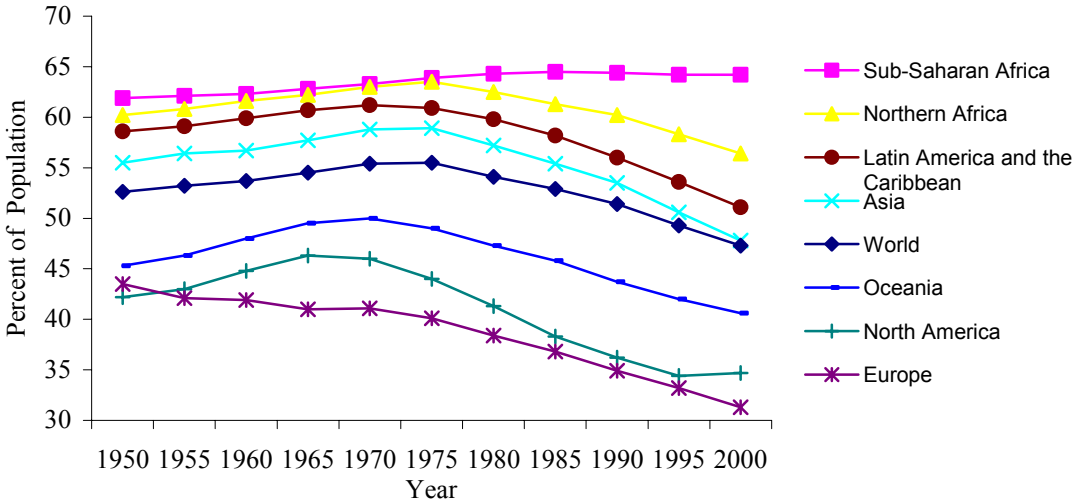
Figure 3.3 *Infant Mortality Rates*



Source: UN (1999).

With regard to age distribution, all regions except Sub-Saharan Africa are now experiencing substantial decreases in the proportion of the total population below 25 years (Figure 3.4). The African regions and Latin America have seen under-25 year shares of more than 60% over the 1950–2000 period. In Europe, the younger cohorts now make up less than one third of the population.

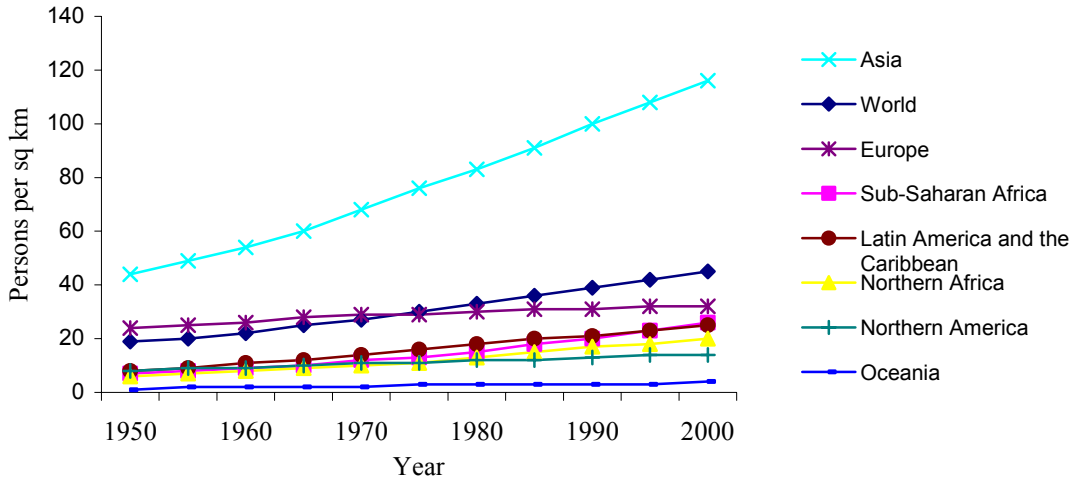
Figure 3.4 *Share Under 25 Years*



Source: UN (1999).

As illustrated in Figure 3.5, population density, measured as total population size over total land area, differ substantially between regions. Throughout the period, Asia has had a much higher density than any other region, presently at 116 persons per square kilometer. Sub-Saharan Africa has been one of the least densely populated regions, although on an increase, while Oceania has had the most space by a wide margin. There are qualifications to be added to these regional numbers, though, especially with regard to population density in Asia. As Lomborg (2001) points out, Netherlands, Belgium and Japan all have higher population densities than India, and Ohio and Denmark far outstrip the density of Indonesia. The population density of the United Kingdom is double that of South-East Asia (UN, 1999).

Figure 3.5 *Population Density*



Source: UN (1999).

Demographic projections have been continuously corrected over the past decades following the relatively rapid, and to some degree unexpected, declines in fertility in the developing world. It is likely that the world the next half-century will see that the total population of the planet is nearing a stationary level. Compared to the present annual growth rates of 1.33%, the medium-variant projection of the UN foresees an annual population growth of 0.38% in the period 2040 to 2050 (UN, 1999). According to this projection, the total population of the world will be close to nine billion by 2050.

4. Research Design

4.1 A Quantitative Approach

The empirical work on the population-conflict nexus is heavily dominated by qualitative case studies, such as the studies at the University of Toronto led by Thomas Homer-Dixon. These case studies have been of great importance in identifying causal mechanisms through which population pressure is believed to influence the risk of armed conflict, and the theoretical framework presented in this study draws heavily on their findings.

King, Keohane & Verba (1994: 85) stress the importance of identifying causal mechanisms, arguing that 'any coherent account of causality needs to specify how the effects are exerted'. While the case study literature fares relatively well in this respect, it is far more uncertain whether the many projects have actually succeeded in identifying significant causal effects, despite such claims. Much of the literature has been criticized for selecting cases on the dependent variable, i.e. only cases in which conflict has occurred (Gleditsch, 2001a: 391; Levy, 1995). One solution to this problem would be to conduct a series of case studies that differ with regard to the values on both the dependent variable and the main explanatory variables. But with a small number of cases, one would still run the risk of ending up with a deterministic model (Lieberson, 1991).

Large-N studies are less likely to be questioned on the ground of case selection, and can test hypotheses over a much broader set of contexts. This increases the likelihood that our causal inferences are correct. The obvious fact that 'correlation is not causation' must never prevent social scientists from stating causal hypotheses or drawing causal inferences (King, Keohane & Verba, 1994: 75). One can never fully reject the possibility that a significant statistical relationship is incorrect as far as causality is concerned. But the finding of a statistical relationship does provide support for a hypothesis predicting a causal relationship. Furthermore, instead of defining variables in

terms of being necessary or sufficient, which is the standard approach in a comparative low-N design, large-N tests allow for the possibility that causes are probabilistic (King, Keohane & Verba, 1994: 87).

The potential weakness of the large-N approach lies in the high level of aggregation. Using states as the units of analysis, one can potentially fail to properly analyze conflicts that are rooted in local contexts, and may ignore local population pressure as causes of local conflicts. It is however difficult to identify *one* sub-national geographic level out of regions, districts or local communities as the appropriate level to address. The advantage of focusing on the national level is that comparable data are widely available. Furthermore, national demographic aggregates are usually also quite good indicators of population pressure on sub-national levels. This is above all due to the likelihood that sub-national forms of population pressure are alleviated through intra-state movements. Overall national population pressure is less likely to be alleviated this way, as migration is restricted on state level. This is not to say that quantitative analyses on a sub-national level would be of little interest. Such analyses would provide very important supplementary knowledge about how population pressure influences the likelihood of internal armed conflict.

If data are not reliable, advanced statistical tools are of little help. Like many other kinds of data used in large-N surveys, demographic data are not very reliable. While for instance the regime characteristics of a country are relatively easily observable to an objective party, they are subject to considerable interpretation. The most problematic point about demographic data is that they generally rely on information provided by each country. There are many examples of biased reporting of demographic data. The Soviet Union and other communist states were consequently under-reporting the level of infant mortality and other mortality data during the cold war, in order to give the impression of having a higher standard of living than they actually did. And methods to estimate demographic characteristics have changed considerably over the past 50 years, causing great disparities in estimates that are obviously due to different estimation techniques. A comparison of different editions of *Demographic Yearbook* (UN, annual) supports this.

In this study I am using UN population indicators (UN, 1999) that have been adjusted in order to avoid problems of underreporting and measurement errors. The data have been run through population models so that unlikely trends have been corrected for. Though the estimates may well deviate from the actual, and today unobservable, demographic characteristics of countries for the past 50 years, the demographic data used in this study are comparable, both over countries and over time. The UN (1999) data cover approximately 92% of my dataset. For the remaining 8% data have mainly been gathered from *Demographic Yearbook* (UN, annual), and some data on total population size have also been collected from *Statistical Abstract of the World* (Reddy, 1994). I believe that the demographic data used in this study are the most reliable data that are available, and that this strengthens my results compared to studies using only data from *Demographic Yearbook*, as in Hauge & Ellingsen (2001).

The other kinds of data used in this study stem from datasets that are frequently used in large-N studies, and that are believed to be of high reliability. Data on regime type are gathered from the Polity Project (Marshall & Jaggers, 2000). This is the regime data that most comparable studies use. My economic data originate from three well-reputed sources, *World Development Indicators* (World Bank, 1999a), the *Penn World Tables* (Summers & Heston, 1991) and the *World Factbook* (CIA, annual). These sources are widely recognized to contain the best economic data available. When necessary, further concerns regarding reliability and validity of data are discussed in section 4.5 under the operationalization of each of the research variables.

4.2 Previous Empirical Work

There has been little systematic comparative empirical research on the causal effects of demographic factors on conflict. Two recent studies, Hauge & Ellingsen (2001) and Tir & Diehl (2001), examine relationships between indicators of resource scarcity and conflict through multivariate statistical analyses for all states in the international system. Both studies to some extent address the assumption that population pressure can lead to conflict over scarce resources. Tir & Diehl (2001) focus on interstate war, and find a significant and positive effect of population growth on the likelihood of onset of

war, while there is no such effect of population density. As in this thesis, the dependent variable in the study of Hauge & Ellingsen (2001) is domestic violent conflict. While not testing for population growth, they find that high population density slightly increases the likelihood of conflict.

The first comparative empirical study of the role of youth bulges in armed conflict was undertaken by Nazli Choucri (1974). By comparing qualitative case studies of 45 'local conflicts' but not comparing these with any control cases, she found that the existence of large youth cohorts did play a minor role in ten conflicts, but was never a crucial factor in the initiation of these conflicts. I am only familiar with two large-N quantitative studies of the effect of youth cohorts on violent conflict. Collier (2000: 97) finds that large proportions of young men in a society increases, although only marginally, the likelihood of civil war. In a revised version of the study, however, he fails to find significant effects of such youth bulges (Collier & Hoeffler, 2002a: 21). Esty et al. (1998) test the effect of large youth cohorts for several categories of 'state failures' for the period of 1955–94, and find that youth bulges significantly increase the likelihood that a country will experience what they characterize as 'ethnic conflict'.

4.3 Value Added to the Population-Conflict Research

All the works mentioned above are rigorous and solid. But for several reasons, many aspects of the population-conflict nexus are still insufficiently explored empirically. The aim of this study is, unlike previous comparable ones, to systematically explore the possible links between several indicators of population pressure and domestic armed conflict in an empirical analysis. I am not familiar with any large-N study addressing the effect of interactions between indicators of population pressure, such as the interaction between population growth and density, for the risk of armed conflict. Nor have I seen anyone testing interaction effects between population pressure variables and important contextual factors, such as youth bulges and regime type, and youth bulges and economic opportunities. The dataset also covers a temporal and spatial domain far greater than previous studies in the field.

As will be argued below, some central demographic measures employed in previous analyses are not satisfactorily operationalized. This goes for both the measure of population density in Hauge & Ellingsen (2001), and that of youth bulges in Collier (2000). Furthermore, Esty et al. (1998) have been criticized both for their sampling methods of conflict and control cases (King & Zeng, 2001), and for their rather wide definition of 'state failure', which is their dependent variable (Hauge & Ellingsen, 2001: 57). None of these previous studies treat the relationship between population pressure and domestic armed conflict satisfactorily.

4.4 Coverage in Time and Space

The units of this quantitative study are country-years. Time intervals could have been smaller (or greater), but most of the data used are available only on an annual basis, minimizing the potential gain from using smaller time intervals. Also, the demographic processes under scrutiny are relatively slow-moving, and drastic changes that can influence the risk of armed conflict usually do not happen within time intervals of days, weeks or even months.

Included are all sovereign states in the international system and all politically dependent areas (colonies, occupied territories and dependencies) for the whole period 1950–2000. An additional criterion for including dependent areas is that their estimated total population had to reach a minimum of 150,000 in 1995. The reason for this is that annual population data are not available in UN (1999) for dependencies with smaller populations. The reason for the temporal restriction is that demographic estimates are generally far more unreliable prior to 1950. Additionally, the conflict data analyzed only go back to 1946.

A considerable number of states leave and enter the dataset as a result of annexations (examples are Germany, Yemen and Vietnam) or partitions (Yugoslavia and the Soviet Union) of states in the fifty-year period analyzed. Demographic data used for this study, however (UN, 1999), are only available for present-day countries, and not for historical states. So data are available for Russia, Ukraine, Belarus and all the other successor states of the Soviet Union for the whole period of 1950–2000, while

data are not available for the Soviet Union as a whole. Similarly, data for reunited Germany are available for the whole period, but not for the separate Eastern and Western entities during the period of separation.

Demographic data are then available for all current states for the whole period from 1950–2000 (UN, 1999), and variables had to be constructed for historical states. For country-years of states that were later partitioned, I merged variables on the basis of the additive values of the successor states (i.e. the total population of Soviet Union in 1950 was constructed from the 1950 population sizes of Russia, Ukraine, Belarus etc.). Ratios and per capita measures were weighted according to each successor state's population size. Merged states are more rare, but constitute a more difficult case. For these states, I had to rely on supplementary historical information sources such as previous editions of the *Demographic Yearbook* (UN, annual). When information was not available for different entities, I assigned the ratios of the united state to all historical parties.

The total number of country-years contained by the dataset adds up to 9,183, covering 217 different states and dependent areas (see Appendix 1 for a comprehensive list). Demographic data are missing for up to 5% of the country-years, depending on the demographic indicator. It is mostly the same country-years that lack information over the different demographic indicators, making the total loss of units related to these variables low.

4.5 Operationalizations

4.5.1 Domestic Armed Conflict

The dependent variable is onset of domestic armed conflict (coded 1 for years of conflict onset, 0 otherwise), and data are drawn from the Uppsala dataset (Gleditsch et al., 2001). This dataset has been published annually in *Journal of Peace Research* since 1993 (Gleditsch et al., 2001: 3) but has only recently been extended beyond the post-Cold War period. Shorter series, mostly for the post-Cold War era, have been analyzed in earlier studies (de Soysa, 2002; Hauge & Ellingsen, 2001). The reason for opera-

tionalizing the dependent variable as onset of armed conflict rather than incidence (the latter including all years of a conflict) is claims that onset of conflict is likely to have a different causation from the continuation of conflict (Gleditsch et al., 2001: 8). In this study, conflict thus refers to domestic conflict *onset* unless specified otherwise. I include colonial wars in my operationalization of conflict, as I see no reason to treat armed conflicts between a liberation army and a present colonial power differently from any other form of internal riot directed towards an autocratic regime.

The Uppsala dataset defines a relatively low threshold for conflict, and distinguishes between minor armed conflict (a minimum of 25 battle-related deaths per year), intermediate armed conflict (at least 25 battle-related deaths per year and an accumulated total of at least 1,000 deaths, but fewer than 1,000 per year), and war (at least 1,000 battle-related deaths per year). In this analysis, I do not distinguish between different levels of conflict. For my purpose I assume that conflict data with a relatively low threshold of violence are more meaningful than data with a higher threshold such as the Correlates of War dataset (Singer & Small, 1994) that only includes conflicts with more than 1,000 battle-related deaths per year. I expect demographic pressure to be more relevant for explaining minor than major conflicts. This applies especially to neo-malthusian forms of population pressure that I believe are most often manifested in local conflicts. Also, using a very high threshold can mean that the starting point of an escalating conflict is not measured correctly, increasing the risk of interpreting correlations with assumed explanatory variables faulty as causal effects. According to the Uppsala criteria, an armed conflict is further defined as a contested incompatibility concerning government and/or territory, between at least two parties, of which one is the government of a state, using armed force (Wallensteen & Sollenberg, 2001: 643).

The reliability of the Uppsala data is high for the years of the original dataset covering the period of 1989 to 2000. However, due to limited and inaccurate historical records, the recent extension of the dataset back to 1945 (Gleditsch et al., 2001) has increased the likelihood that episodes of armed conflict are underreported. This problem may be greater for the Uppsala data than for other conflict data precisely because of its lower threshold. Low-intensity armed conflicts can more easily be hushed up than wars. This potential problem will remain unsolved. I assume that the problem is

most severe for low-intensity conflicts that took place in the beginning of the period covered by the dataset.

A substantial number of the conflicts registered in the Uppsala dataset broke out at a time when there was already at least one other conflict going on in the same country. Typically, large countries like India and Indonesia have experienced several local conflicts taking place at the same time. The number of such overlapping conflicts is greater for the Uppsala data than for most other conflict datasets, since the Uppsala data include a large number of low-intensity conflicts. During the period of 1950–2000, 38 out of a total of 245 conflict onsets happened at a time when the country was already experiencing another armed conflict. As will further be discussed below, overlapping conflicts pose a methodological challenge since studies of armed conflict onset usually study transitions from peace to war, omitting consecutive years of war.

My solution to this has been to code the dependent variable in two ways. The first restricted coding (‘Onset1’) only includes armed conflicts that erupted in a state of peace. The consequence is that if a country that is already in conflict experiences another conflict, this later conflict is treated as a spread of the first conflict, and not coded as a separate one. An objection to such a restriction would be that it is questionable to treat all higher-order conflicts as spreading of the first no matter what the incompatibilities are. And by omitting a high proportion of all conflicts, much information is lost.

The second coding (‘Onset2’) includes all armed conflict onsets regardless of whether the conflicts broke out in a state of peace or war. The only exception is if more than one conflict broke out in the same country in the same year, such rare cases are coded as one conflict onset only. One relevant objection to this approach is that I run the risk of violating the assumption that the explanatory variables are endogenous. Many of the independent demographic, economic and regime variables in this analysis are believed to be strongly influenced by the incidence of armed conflict. On the other hand, it could be argued that changes on the explanatory variables following from an ongoing conflict could actually be causes of consecutive armed conflicts. For the purpose of the study of the more extended conflict data I will return to the potential problem of endogeneity.

Table 4.1: *Distribution of Armed Conflict on Continent 1950–2000*[11]

	All years	America	Europe	Africa	Asia	Oceania
Country-years, Total	9,183	1,921	1,797	2,634	2,220	611
Conflict Onset, From Peace	207	30	22	88	65	2
% of all Country-Years	2.3	1.6	1.2	3.3	2.9	0.3
Conflict Onset, All	245	30	24	95	94	2
% of all Country-Years	2.7	1.6	1.3	3.6	4.2	0.3
Total Years in Conflict	1,143	143	63	420	510	7
% of all Country-Years	12.4	7.4	3.5	15.9	23.0	1.1
Mean Length Per Conflict[a]	5.5	4.8	2.9	4.8	7.8	3.5

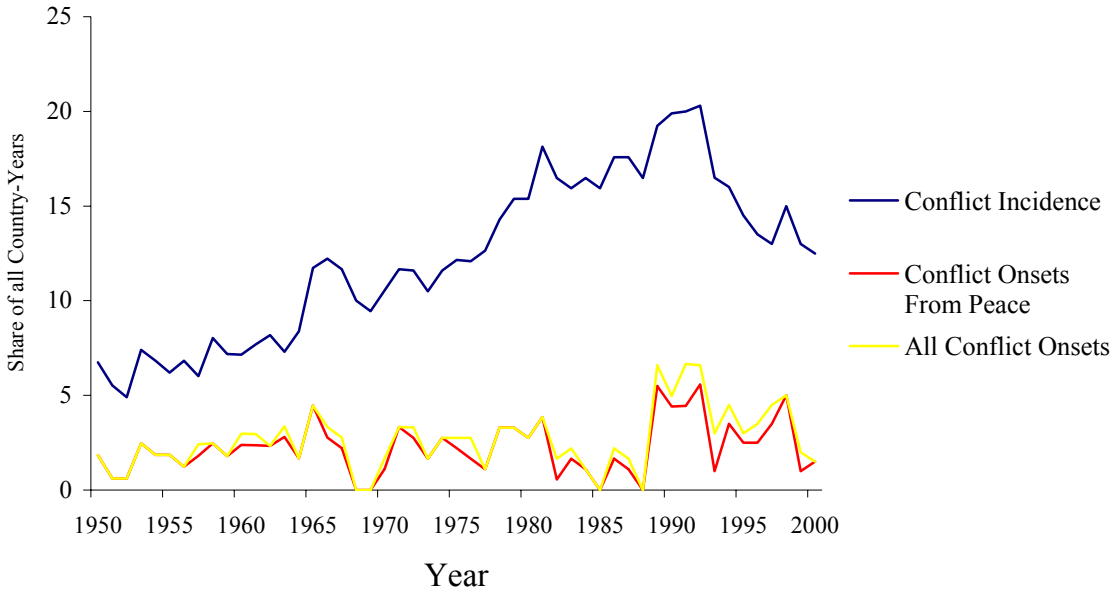
Source: (Gleditsch et al., 2001)
[a]Based on 'Onset1', Measured in Years.

If a conflict fell below the threshold of 25 deaths for at least one year for then to blaze up again, this renewed conflict is coded as separate from the first. This applies to both ways of coding. The descriptive statistics show that domestic armed conflicts are unequally spread between regions (Table 4.1).

Africa has been the continent experiencing the highest number of conflict onsets from a state of peace (Onset1) relative to the continent's total number of country-years, while Asia has experienced the highest relative number of all conflict onsets, the highest relative number of years in conflict, and the longest lasting conflicts. Fortunately, armed conflict onset is a relatively rare phenomenon, only 2.7% of all country-years in the period 1950–2000 have experienced a conflict onset. The likelihood of experiencing a conflict onset is greater if the country is already at war; in 4.2% of the 1,143 country-years in conflict there is another conflict onset. While in only 2.5% of all years in peace is there an onset of armed conflict.

[11] Collier & Hoeffler (2002b) have shown that the reason for the higher frequency of conflict in sub-Saharan Africa is not due to some unexplained continental-cultural traits, but to the accumulation of conflict-generating factors that explain conflict onset worldwide. This is also confirmed in my study; no continental dummy variables yield statistical significant results when all important explanatory variables are included.

Figure 4.1 *Armed Conflict Incidence and Conflict Onsets 1950 – 2000, Relative to the Number of Countries per Year*



Source: Computed from the data in Gleditsch et al. (2001)

Figure 4.1 shows that armed conflicts have become much more frequent over the past 50 years, although there was a considerably drop in the relative number of country-years that experienced an ongoing conflict after the top year 1992. The data should be comparable over time since conflicts that started prior to 1950 are counted as ongoing conflicts if they continued into the 1950s. Conflict onsets are more evenly spread over time, but there was a considerably higher frequency of onsets in the period 1989–92, reflecting largely the dissolution and following conflicts in the former Soviet Union and Yugoslavia. At the end of the period, the relative incidence of conflict onset dropped. Conflicts that erupted from a state of conflict have become slightly more frequent in the 1990s.

4.5.2 Population Growth

Data on all the main demographic independent variables are primarily drawn from the dataset 'Sex and Age Quinquennial 1950–2050' (UN, 1999). This dataset is produced by the Population Division of the Department of Economic and Social Affairs of the

United Nations, and contains demographic data for all independent countries and several dependent areas with total populations of more than 150,000 in 1995.

To measure *population growth* I have used the available estimates of annual population growth over six-year periods (1950–55, 1955–60 etc.). For the relatively low number of states with smaller populations than 150,000 in 1995 (in the following referred to as 'small states') such data was not available through the UN dataset, and I have collected data on total population from *Demographic Yearbook* (UN, annual) and *Statistical Abstract of the World* (Reddy, 1994). Since data on total population are not available on an annual basis for all countries, I have interpolated linearly between the observed data points.[12] Population growth rates were then calculated on an annual basis.

Since population growth rates are constant over each five-year period for most countries, this measure represents population growth trends over a longer time period than just one year. In addition, I have lagged the measure with five years. These features strengthen the validity of the variable as an indicator of population pressure, as such pressure is believed to be a result of long term and aggregative processes. I assume that it takes some time before, as Thomas Homer-Dixon claims, a strong increase in population may result in migration and reduced economic and agricultural productivity. Since population data are not available for the period of 1945–50, I have assumed that growth rates for these years were identical to those of 1950–55.

4.5.3 Population Density

Thomas Homer-Dixon claims that 'population size and growth are key variables producing the syndrome of environmental scarcity' (1991: 102). But population size is totally irrelevant if it does not relate to the resource base. Defining population density relative to the total area of a country, as done by Hauge & Ellingsen (2001), misses the

[12] My choice of linear interpolation produces very similar results to those obtained through exponential interpolation. While the latter would have been more theoretically appropriate, the former alternative was technically easier given the data structure.

important aspect that countries differ significantly with respect to the productive capacity of their territory.

I have aimed to establish a measure of *population density* that relates the number of people in a country to the area available to them that potentially can be used for food production, what I call *arable* land. In a globalized and trading world such a measure may seem as an anachronism, since countries that possess other kinds of resources can trade the food they need. In many developing societies, however, self-subsistence agricultural production is an important way of living for a great number of people. And it is precisely the lack of available cropland in conflict-ridden developing societies that has been the main concern of neo-malthusian literature.

Earth quality and other conditions influencing the crop potential differ substantially between, but also within, different climate zones. This makes comparisons of food production potential somewhat unreliable. I rely on data on land-use that originates from FAO (Food and Agricultural Organization of the United Nations), assuming that these should be comparable over countries. The FAO data have been available through the *World Factbook* (CIA, annual) as the share of total land area that is arable land. I define arable land to include all sorts of land that people potentially can use for any kind of agricultural production, either harvests or cattle. I also include forests in this definition, since I believe that forests are reservoirs of fertile land that most likely will be cut down to clear new land for food production if there is a pressure on land resources. This definition of arable land is far more extensive than the conventional meaning of the term, which usually includes cultivated land only.

I define arable land as all of a country's land that fall into the following FAO categories: arable land (cultivated for crops that are replanted after each harvest), permanent crops (cultivated for crops that are not replanted after each harvest), permanent pastures (land permanently used for herbaceous forage crops), and forests and woodland (land under dense or open stands of trees) (CIA, annual). Land that is excluded from this definition includes, but is not limited to urban areas, mountains, roads and deserts. I base the measure on observations for one year per country only, and the estimates date from the period 1993–2001. I thus ignore the problem of changing land use over time, since reliable information is not available for a large number of coun-

tries. Unfortunately, the measure is probably not as reliable as I should have wished. Very different types of land assumed to have very different qualities regarding food production potential are categorized together. Also, the data do not take into account different climate zones that also matter a lot to food production potential. More ideal measures weighting the quality of land more properly according to its' food production potential may be available in the future. But despite extensive searching, I have not been able to find a more reliable indicator for arable land.

Since data on arable land have been available as shares of total land area, I have gathered data on total land area (in square kilometers) from the *World Development Indicators* (World Bank, 1999a), the *World Factbook* (CIA, annual), and the *Encyclopedia Britannica* (Britannica, annual). The data on total population size originate from UN (1999), and have been available to me only as estimates for every five years (1950, 1955, 1960 etc.). For the non-observed years I have interpolated total population linearly between the five-year data points. To cover the period from 1995 to 2000 I have interpolated between the 1995 estimates and the 2000 medium projection numbers. For small states I have collected data on total population from *Demographic Yearbook* (UN, annual) and *Statistical Abstract of the World* (Reddy, 1994).

Thus, population density is defined here as total population size over the total number of square kilometers of arable land. The variable is log-transformed in order to reduce the huge variation in values, especially represented by city-states with extreme values, such as Macau, Hong Kong and Monaco.

4.5.4 Refugees

Large-scale and sudden cross-border movements of *refugees* are likely to pose a great challenge to the host state with regard to providing subsistence to the refugees. In some cases, large refugee populations can put a strain on the natural resources of the area of arrival, potentially competing over resources with the original inhabitants.

Data on refugee populations is available only for recent years. For establishing a refugee measure, data has been drawn from statistics of the United Nations High Commissioner for Refugees (UNHCR, 1998, 1999, 2000). I have created a dummy

variable taking on the value 1 for countries that hosted more than 100,000 refugees in a given year, and 0 otherwise. Refugees are defined by UNHCR as those who are recognized as such by the 1951 United Nations Convention or its 1967 Protocol, or by the 1969 Organization of African Unity (OAU) Convention, and otherwise persons recognized as refugees in accordance with the UNHCR Statute, and persons granted humanitarian status or temporary protection (UNHCR, 2000: 1). The definition only applies to people who have taken refuge in another country than their country of origin. Reliable statistics on internally displaced persons, which can be seen as another possible indicator of population pressure, is not available.

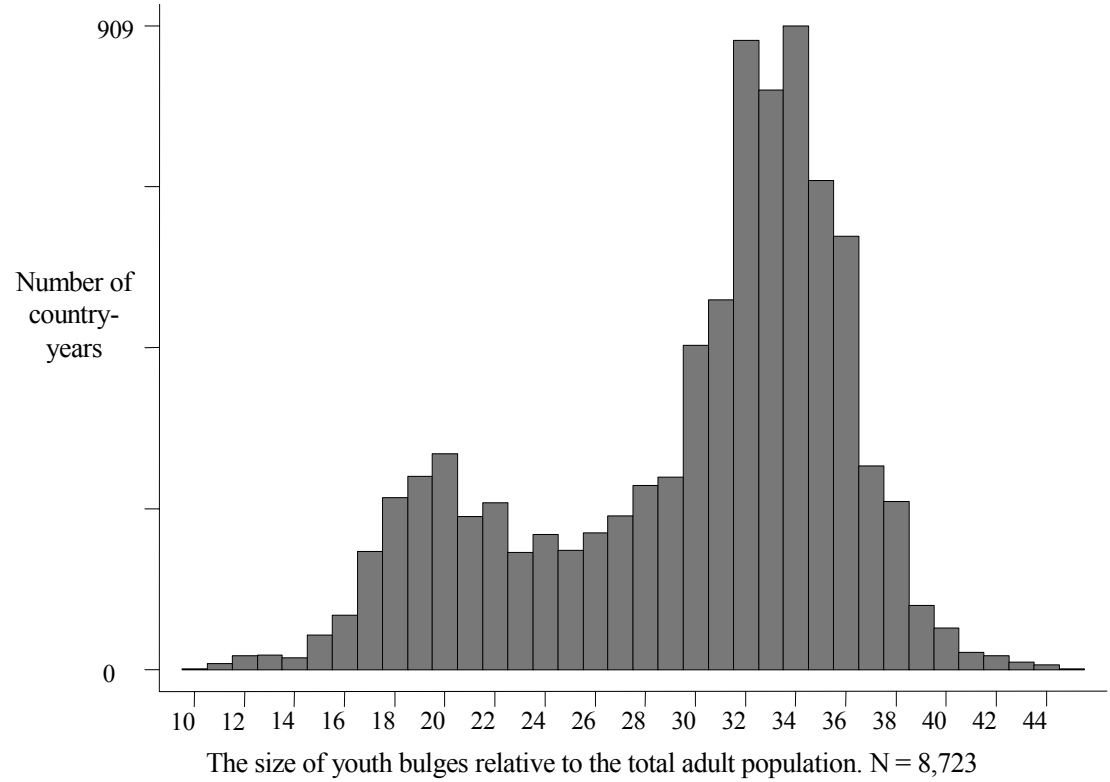
Since the UNHCR only estimates annual 'net' refugee populations and not gross refugee movements in and out of a country, it is not possible to establish a measure that takes into account possible temporal effects, i.e. whether refugee movements have an effect on conflict propensity within a certain time period after arrival. I am thus only able to measure whether the presence of a large refugee population increases the likelihood of armed conflict. Data on refugee populations is available for the years 1988–99 only. All estimates are as of 31 December, and the variable is lagged one year in order to determine causality. Estimates of the size of refugee populations are generally very unreliable. Since I have dichotomized the variable and used a high threshold, I believe that it is unlikely that I have inadvertently omitted cases of large-scale refugee movements.

4.5.5 Youth Bulges

The literature suggests several ways to operationalize *youth bulges*. Some of these suggestions produce serious flaws that could easily jeopardize the possibilities of detecting effects of youth bulges on armed conflict. Somewhat surprisingly, the operationalization producing the most serious flaw is used by many prominent theorists (Collier, 2000; Goldstone, 2001; Huntington, 1996) without any discussion about its validity. That is to measure the size of youth cohorts (most commonly defined as those between 15 and 24 years) relative to the total population rather than to the adult population.

First, this is not theoretically sound. Most theories about youth revolt assume that conflict arise as a result of competition between younger and older cohorts, or because youth cohorts run into institutional 'bottlenecks' because they are more numerous than previous cohorts. Second, rapid growing youthful populations will then get an unreasonable low score for youth cohorts because their under-15 populations are so large that this inflates the total population. To avoid this, I have chosen to measure youth cohorts as 15–24 year-olds relative to the total adult population (15 years and above). Data on age distribution are drawn from the *World Population Prospects* (UN, 1999), and from the *Demographic Yearbook* (UN, annual) for small states.

Figure 4.2 *Distribution of Youth Cohorts, All Country-Years 1950–2000*



Source: UN (1999) and UN (annual)

As Figure 4.1 shows, the values for youth cohorts between the ages 15 and 24 vary greatly between 10% and 45% of the total adult population for this dataset. The industrialized countries of Western Europe, North America, Japan, Australia and New Zealand all have youth cohorts between 13% and 20% today, with the exception of Ireland. The most frequent values are between 30% and 36%, representing a heteroge-

neous group of country-years with respect to geography, level of development and regime characteristics. The mean value for the whole dataset is 29,8% while the median is 32%. Historically, high values close to 45% were achieved by small island states such as Cape Verde, Western Samoa, Guam and St. Kitts-Nevis that probably experienced high levels of labor emigration. Countries like Liberia and Zambia have experienced especially large youth cohorts in the late 1990s, and among the 20 countries with the greatest youth bulges in 2000, 15 were in Sub-Saharan Africa. Three were in the Middle East, Gaza, Syria, and Yemen, while the remaining two were Guatemala and Nicaragua in Central America. Countries with exceptionally small youth cohorts include Monaco, Germany, Italy and Switzerland.

Huntington (1996: 259–261) argues that societies are especially war prone when the number of young people aged fifteen to twenty-four reaches a 'critical level' of 20% of the overall population in a country. By dichotomizing the youth cohort variable or introducing a threshold level, much information would be lost compared to a continuous measure. Nor do I believe that there are absolute critical levels that make countries that tip over especially conflict prone. It could be, however, that the effect of youth bulges on conflict is not linear, but increases with larger youth cohorts. To investigate whether the effect of youth bulges may take a curvilinear form, I will include a squared term for youth bulges.

4.5.6 Control Variables

Existing literature suggest a broad variety of other factors that can contribute to explain the incidence of domestic armed conflict. In this analysis I include a set of control variables that measure some important causes of conflict.

Level of *development* is a variable that has been found to strongly influence the likelihood of domestic armed conflict (Collier & Hoeffler, 1998; de Soysa, 2002; Hauge & Ellingsen, 2001; Hegre et al., 2001; Henderson & Singer, 2000). Development as a concept conveys a wide range of aspects, and there are many different, and often conflicting, theoretical explanations that aim to explain how and why societies get more peaceful through development. Referring to Douglas A. Hibbs' moderniza-

tion theory, Hegre et al. (2001: 37) argue that developed countries are more peaceful since development reduces class conflict, which stimulates the establishment of institutions that promote negotiated settlements. This implies a theoretical expectation of a higher conflict propensity in countries that are in an early stage of industrialization than for very poor and pre-industrialized countries.

de Soysa (2002) focuses more on the role of higher state revenues, following from higher income, which enable states to pacify, or crush opposition. Wealthy countries can also more easily redistribute resources in order to dampen dissatisfaction (Henderson & Singer, 2000: 281). On the individual level, increasing income means that the opportunity costs of potential rebels increase following from their possible earnings in the regular economy (de Soysa, 2002).

Most comparable studies have applied indicators of development that primarily capture economic aspects of income and industrial production, such as GDP per capita (de Soysa, 2002; Hauge & Ellingsen, 2001) or energy consumption per capita (Hegre et al., 2001; Henderson & Singer, 2000). There are two main weaknesses in these measures. First, they do not account for possible internal inequalities, and second they do not directly capture non-economic issues of development that potentially influence people's quality of life. Sambanis (2002: 27) argues that findings from quantitative studies of civil war suggest that economic policies that not only promote economic growth, but also increase levels of education and improve public health, reduce the risk of civil war significantly.

In this study I apply a proxy variable that may better capture the many aspects of development, the infant mortality rate (IMR).[13] Amartya Sen (1998) has argued that mortality is a good indicator of a country's level of development. And, as argued above, the level of infant mortality in a society is highly dependent on both material living standards, levels of education and health care systems. In addition to capturing non-economic aspects, IMR is not nearly as flawed by distributional effects since the

[13] For the sake of comparison, I also constructed a measure of log-transformed GDP per capita based on information from the *World Development Indicators* (World Bank 1999a), the *Penn World Tables* (Summers & Heston, 1991) and the *CIA World Factbook* (CIA, annual). The GDP data cover 76% of my dataset.

rich cannot fully make up for the poor in societies with great inequalities. Another great advantage of IMR over other proxies for development is its broad availability for the period studied here.[14] The IMR is defined as the fraction of live-born children who die before the age of one year.

IMR data have been gathered from the *World Population Prospects* (UN, 1999), and the *Demographic Yearbook* (UN, annual) for small states. The data have been available to me only as rates for six-year periods (1950–55, 1955–60 etc), and not for single years. To avoid the possibility of conflict influencing the level of IMR, I lagged the variable for some countries where infant mortality rose dramatically in connection with armed conflict.[15] I chose not to do a universal lag of this variable, as IMR may change rapidly. Such a lag would mean that conflict would be explained by the level of infant mortality some 5–10 years prior to the year of observation. The IMR variable has been log-transformed in to reduce the great variety, and I also include a squared term for the log-transformed IMR in order to investigate whether the conflict proneness related to development may follow a moderate curvilinear pattern as found by Collier & Hoeffler (1998) and Hegre et al. (2001).

Could infant mortality be too closely connected to other central demographic measures? Infant mortality is clearly a factor influencing especially population growth and youth bulges. But processes of demographic change are complex and, as argued in chapter 3, a number of other factors than infant mortality are involved. However, youth bulges correlate strongly with *both* IMR and GDP per capita, suggesting that multicollinearity may be a problem in models including any of the development proxies. I will return to the issue on how to avoid this problem later. Correlation between population growth and IMR is not troublesome.

Population growth and youth bulges can be viewed as intermediary variables between infant mortality and armed conflict. Since infant mortality levels are impor-

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[14] Given the high correlation between the measures of IMR and GDP per capita (Appendix 5), data availability is probably the single most important argument for using IMR as a proxy for development.

[15] Iraq (1985-90 level lagged to 1991), Rwanda (1985-90 level lagged to 1991) and Sierra Leone (1985-90 level lagged to 1991).

tant predictors of population growth and youth bulges, the inclusion of IMR in the models will contribute to tap the effect of these two measures. This will strengthen any significant results of population growth and youth bulges on conflict.

A second control variable previously found to strongly influence the likelihood of domestic armed conflict is *regime* type. While the democratic peace argument is a well-known explanation of why democracies never fight each other, the level of democracy is also found to have an impact on the incidence of armed conflict (Hegre et al., 2001). The impact of regime type is generally believed to take an inverted U-shaped form, meaning that stark autocracies and fully developed democracies are both less likely to experience conflict than the intermediate and more unstable regimes. I find this assumption identical to the state weakness hypothesis presented in Section 2.1.6, arguing that regime type is defining the opportunities for conflict. Democratic regimes offer opportunities for peaceful voicing of grievances, while strong autocratic regimes will oppress all attempts of opposition. Intermediary regimes are the weak states that neither offer democratic institutions to voice grievances peacefully, nor possess the oppressiveness of the autocracies.

I use the Polity IV data (Marshall & Jaggers, 2000) to measure regime type, the most updated dataset include information up until 1999 for all independent states with populations greater than 500,000. The Polity score is coded based on the authors' subjective assessment of the three elements; 'the competitiveness of political participation, the openness and competitiveness of executive recruitment, and the level of constraints on the chief executive' (Jaggers & Gurr, 1995: 471). Two regime dimensions ranging from 0 to 10 are measured independently by the Polity project, one representing aspects of democracy and one aspects of autocracy. I follow Hegre et al. (2001) and others, and establish one single regime indicator, subtracting the score for autocracy from that of democracy. The values for the regime variable thus ranges from -10 (most autocratic) to 10 (most democratic). I use this as a continuous measure, and also include a squared term in order to measure the assumed inverted U-shaped effect of regime on armed conflict. The Polity codings are from the end of the year, and the variable is thus lagged one year in order to determine causality.

The Polity data are consistent and correlate strongly with other often-used measures of democracy, such as the Freedom House's political rights and civil liberties index and the Polyarchy index focusing on participation and competition exclusively in electoral processes (Jaggers & Gurr, 1995: 474; Vanhanen, 2000: 260), indicating that validity and reliability is high. One problem about the Polity data, however, is that during periods of armed conflict and war, countries are assigned special missing codes ('transition codes') if the central political authority collapse, or if a country is occupied by a foreign power. These situations occur regularly under episodes of armed conflict. When assessing my dataset I find that for country-years of conflict onset, transition codes for the Polity index occur three times as often as they do for all country-years. Since Polity data generally do not exist for politically dependent areas, a total of 18% of all observations of armed conflict onset have no regime information. As will be further described below, I have used a simple data imputation method to avoid a loss of units.

As yet another control variable, I include an indicator of *economic opportunities*. The relative deprivation hypothesis states that the likelihood of conflict increases as the gap between people's expectations of an economic outcome and what they actually get becomes greater. One way to measure the level of relative deprivation is to address relative changes in the economy rather than the absolute level of wealth, as people generally relate their economic situation to their own past experience. If economic opportunities are worsening through economic recession and rising unemployment, this is likely to cause grievances no matter the prior level of wealth.

I found the best way to operationalize economic opportunities to be the average annual change in GDP per capita over the five-year period prior to the year of observation. I believe that a decrease in the income level over a longer period will produce higher unemployment and less wealth to share, and that this is a valid measure for economic opportunities. Homer-Dixon (1994: 26) argues that 'more recent research has shown that, to cause civil strife, economic crisis must be severe, persistent, and pervasive enough to erode the legitimacy or moral authority of the dominant social order and system of governance'. As argued above, limited economic growth is considered in neo-malthusian theory to be an intermediary variable between population pressure

pressure and armed conflict. The inclusion of this variable could thus tap some of the causal effect of population pressure variables.

An argument questioning the reliability of this measure is that it does not capture alternative income-earning opportunities such as self-subsistence farming and black-market activities, ways of generating income that are of great importance in many developing countries. Despite this, I believe that GDP per capita growth is the most reliable measure. One alternative measure of opportunities, the rate of unemployment, only covers a very small part of my country-years, and information is unreliable for a large number of countries. GDP per capita data have been gathered from the *World Development Indicators* (World Bank, 1999a), the *Penn World Tables* (Summers & Heston, 1991) and the *World Factbook* (CIA, annual).

The states studied here include multi-cultural mega-states with more than one billion inhabitants, and also ethno-linguistic homogenous mini-states with only some ten thousand people. It is likely that these structural differences influence conflict propensity, and one way to partly account for these differences is through including a variable for *total population* size. I believe that the size of a state's population influences the propensity for conflict both because more people means more potential constellations for conflict and generally a higher degree of linguistic, religious, ethnic or cultural fractionalization, and second because larger populations to a considerable extent mean larger geographical areas that are more difficult to keep together than smaller areas. Data are drawn from the *World Population Prospects* (UN, 1999), and from the *Demographic Yearbook* (UN, annual) for small states. The variable is log-transformed as I assume the size of the population to have a diminishing effect on conflict.

Finally, I also control for political *dependency* status and *communist state dissolution*. Political dependency is a dummy variable coded 1 for political dependent areas, and 0 for sovereign states. The data were gathered from Gleditsch & Befring (1986), the *Encyclopedia Britannica* (Britannica, annual), and the *World Factbook* (CIA, annual). Communist state dissolution is also a dummy variable, coded 1 for all successor

states for five years following after the dissolution of the Soviet Union and the Federal Republic of Yugoslavia, and 0 otherwise.[16]

4.6 Statistical Method

The dependent variable in this analysis is dichotomous, taking the value 1 for years of the event that I study, conflict onset, and 0 for the non-event, years with peace. Thus, the use of OLS regression would be inappropriate as it may predict values outside the 0–1 interval. I will use logistic regression, which is better suited for treating dichotomous dependent variables, and will apply a discrete time event history model. The logit model is specified as

$$\text{Log}(P_{it}/(1-P_{it}) = \alpha + \beta X_{it} + e_{it}$$

Where α is the intercept, βX is a set of (possibly time-dependent) explanatory variables with corresponding coefficients, e is the random error term, for country i at time t.

Like in many comparable analyses of domestic armed conflict, the nature of the available data forces me to measure all observations in discrete time, and aggregated over countries. Ideally, one could wish to have data for smaller time intervals and for smaller geographical areas, but the country-year framework is most likely detailed enough to answer my hypotheses. Most quantitative studies of domestic armed conflict use the country-year as the basic unit of analysis (Gleditsch et al., 2001: 8).[17]

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[16] The reason why I include such a variable is because the many conflicts in the successor states of the Soviet Union and the Federal Republic of Yugoslavia in the beginning of the 1990s are not well explained by the model suggested here. This causes a problem especially for the youth bulge variable, since almost all of the former communist states had very small youth cohorts in this period. Early runs of my model yielded predictions of increased risks of conflict onset both on very low and on very high values of youth bulges, and I believe the former result is due to the many conflicts in post-communist states. When ranging episodes of conflict onset after the size of the youth cohorts in the country, 11 out of the 17 conflict onsets in the countries with the smallest youth cohorts took place in successor states of the Soviet Union and the Federal Republic of Yugoslavia within few years of dissolution. Since there have been no suggestions that conflicts in these post-communist states were attributable to high dependency burdens or other effects of small youth cohorts, I believe that the inclusion of a post-communist dummy variable will potentially capture effects of causal variables that are unobserved in my model.

[17] Despite its wide use, the nation- or dyad-year approach is disputed. Raknerud & Hegre (1997: 387) argue for instance that 'the problems with the dyad-year tradition fundamentally derive from statistical dependence', and suggest instead a continuous-time Cox-regression model. In this study I apply some suggested remedies for statistical dependency into a basic country-year model.

The initial assumption for a logistic regression is independence across all observations. This independence is not easily defended in this case. There is very likely to be dependence in time and possibly in space. An example of the latter is if an armed conflict in one country spread into another country to cause conflict there. The former is illustrated by the higher conflict probability of countries that have experienced conflict before, compared to countries with no conflict history (Gleditsch et al., 2001). More obviously, a country that experiences conflict over several years will find subsequent years of conflict to be heavily dependent on the first year. It is common in the literature to avoid this latter problem by omitting all observations of conflict, except for observations of the onset of conflict given that the country was at peace at t-1. But this is not unproblematic with regard to the phenomenon being explained. Since a new conflict can erupt in a country already in civil war, we risk loosing valuable information. India is a good example, where there are several parallel conflicts over different incompabilities. A scientifically sound approach to this problem is to apply several operationalizations of the dependent variable, remedying the different problems and observing whether the results are robust to the different approaches.

The first operationalization, 'Onset1', includes only armed conflicts that erupted in a state of peace. It is logically only possible to have transitions from peace in the whole of the country to armed conflict, even though the conflict takes place in a remote part of the country. This is by far the most common way to operationalize conflict in comparable analyses.[18] When using this dependent variable, units of consecutive years of a conflict are omitted from the analysis. This is the methodologically most sound approach, but as discussed above, not without a cost.

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[18] Gleditsch et al. (2001: 8) note that '[m]ost quantitative studies of armed conflict use the country-year or the dyad-year as the basic unit of analysis. The dependent variable may be the onset of a new conflict, the onset of new dyadic conflict (a new country joining an on-going conflict), or the incidence of conflict in a given year. While Bremer (1992) argues that the onset of war is likely to have a different causation from the continuation of war, Russett & Oneal (2001: 95), on the other hand, hold that leaders reevaluate their positions during a conflict and that it is therefore most appropriate to use incidence of conflict as the dependent variable. Others (Gleditsch & Hegre, 1997) report results for onset as well as incidence, in order to test if their findings are robust. Each type of analysis raises some substantive and statistical problems.' Some examples of quantitative studies that differ with regard to theme, but use country-years or dyad-years as the basic unit of analysis and conflict onset as the dependent variable are Oneal & Russett (1999), Henderson & Singer (2000), Buhaug (2001), Fearon & Laitin (2001), King & Zeng (2001).

The second operationalization, 'Onset2', derives from a different logic. When using this measure as the dependent variable I assume that I investigate transitions from peace in one part of the country to armed conflict in that part of the country. This allows for the possibility that there can be other transitions from peace to armed conflict in other parts of the country even though there is already an armed conflict going on. Consequently, I do not omit consecutive years of conflict from the analysis. Instead I include a dummy variable that takes the value 1 for all years of conflict except the year of onset of the first conflict, and 0 otherwise. This variable, termed *ongoing conflict in country*, controls for spatial dependence. It may be easier to a rebel group B to act militarily on the government, if the government is already involved in an armed conflict with group A.

Omitting consecutive years of war, as I do for one of my dependent variables, does not solve the problem of time dependency entirely because the same statistical dependency prevails for consecutive years of peace. This problem is thoroughly described in quantitative political analyses.[19] To account for it, I will apply a control variable for time dependency that is widely used in comparable analyses: the number of years in peace since the previous conflict.[20]

It is generally assumed that the risk of experiencing a new conflict is high in the immediate time after an armed conflict, and that this risk diminishes as time goes by and wounds are healed. [21] I have chosen to follow the suggestion by Hegre et al. (2001) and assume that the effect of a previous conflict is decaying over time according to the formula exp{(-years in peace)/X}. I call this variable *brevity of peace*.[22] In

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[19] For an excellent introduction to this debate, see Raknerud & Hegre (1997), and Beck et al. (1998). For a further discussion on methodological design in relation to time dependency and other fundamental problems in cross-sectional and cross-temporal conflict data, see the discussion on fixed-effects versus pooled cross-sections analyses in the special symposium on research design and method in IR in International Organization 55(2) (Green et al., 2001; Oneal & Russett, 2001; Beck & Katz, 2001; King, 2001).

[20] For different applications of years in peace as time dependency control, see Beck et al. (1998) and Hegre et al. (2001).

[21] I have not seen any theoretical suggestions for what is a reasonable half-life for the onset of conflict. Scholars have generally tested empirically what value provides the best fit (maximizes log likelihood). Thus the assumptions for the time it takes before the effect of a previous conflict is halved ranges from three to sixteen years in three comparable studies (Toset et al., 2000; Hegre, 2000; Hegre et al., 2001).

[22] Håvard Hegre uses this term in his most recent studies, and I am grateful to him for suggesting the term to me.

the formula, 'years in peace' is the number of years since a country experienced an armed conflict, while the value on X decides at what rate the effect of a previous armed conflict on conflict proneness diminishes over time. In this study, the value chosen for X is 4, which means that the risk of conflict is halved approximately every 3 years. This value for X is chosen because it maximizes the log likelihood in model 1 (log likelihood = -819.01).[23] The brevity of peace variable takes on values close to 1 immediately after the end of a conflict, while it comes closer to 0 as time goes by. For countries that have never experienced armed conflict in the period studied here, I assign the value 0.[24]

I will also apply a control variable for dependence across events, counting the number of previous conflicts. The variable *previous conflict* is coded as the number of conflict onsets a country has experienced prior to a given year of observation. This reflects the assumption that grievances caused by prior armed conflict increases with the number of previous conflicts. The variable takes the value 0 for all countries that enter the dataset, and increases by one for each conflict onset that is coded. Two alternative variables are coded, corresponding to the two differently coded dependent variables.

Since my dataset include so many states and dependent areas, some of the variables are missing values on a relatively high number of units. In order not to decimate the number of units analyzed, I have assigned the value for the sample average for missing values on the regime (31% missing) and economic opportunities (24% missing) variables. I have additionally created two dummy variables, *missing regime data* and *missing economic data* corresponding to the two variables, taking on the value 1 if information on the corresponding variable is originally missing from the dataset, and 0 otherwise. These dummy variables control for potential skewness caused by imputing the mean value. If such a dummy variable should yield a statistically significant effect, this means that the units that have been assigned the value for the sample average have

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[23] A brevity of peace variable in the same model assuming a half-life of five years produced a log likelihood of -822.6, ten years one of -826.0, and sixteen years one of -827.8.

[24] Since information on domestic armed conflict prior to 1945 is not available, the variable is systematically underestimated.

a significantly different risk of conflict than units that originally takes on the value of the sample average, all other things being equal.[25]

[25] The method of imputing the univariate mean value and controlling for skewness through a dummy variable is a well-used technique among statisticians in order to avoid listwise deletion of units with missing values. But this procedure is controversial. King et al. (2001: 66) argue that such a method may be biased or inefficient, and that it may 'give standard errors that are too small because they essentially "lie" to the computer program, telling it that we know the imputed value with as much certainty as we do the observed values' (ibid.). King et al. (2001) suggest instead to carry through a multivariate imputation procedure. This procedure is however less suited for my dataset since I would then impute values for regime and economic variables based on demographic variables alone. Because I would have questioned the reliability of multiple imputed variables in this case, and because the variables with the most severe problems of missing values are control variables rather than main explanatory variables, I assume that the procedure that I have chosen here is the most appropriate.

5. Testing the Population Pressure Hypotheses

In this chapter I aim to test the population pressure hypotheses from Chapter 2. I derived two sets of hypotheses in that chapter. The neo-malthusian hypotheses assume that countries experiencing high population growth and population density, and especially the combination of the two, and countries hosting large refugee groups are more likely to experience a pressure on natural resources, and thus more exposed to the risk of armed conflict. The youth bulge hypotheses assume that countries with large youth cohorts are more likely to experience armed conflict, and especially so if the countries at the same time experience low economic growth and if they score low on the regime variable (are more autocratic).

To get a first idea of how my population pressure variables are related to armed conflict, I present bivariate analyses in Table 5.1. The results are unfit for drawing conclusions regarding causal relationships, but they give an indication of the demographic characteristics of countries that experience conflict. Later I will control for other relevant factors.

Table 5.1 *Bivariate Analyses of Armed Conflict, 1950–2000, All States and Dependent Areas*

Neo-Malthusian Population Pressure Variables	**β**	**st.e.**	**p-value**	**N**
Population Growth	0.043	0.039	0.274	8,247
Population Density, Arable Land	-0.119	0.039	0.003	8,083
Population Density, Total Area	-0.098	0.042	0.018	8,227
Growth x Density	-0.001	0.007	0.873	8,083
Refugees	1.052	0.261	<0.0005	2,043
Youth Bulges				
Youth Bulges	0.083	0.014	<0.0005	7,787
Youth Bulges, Squared	0.0002	0.002	0.898	7,787
Youth Bulges x Regime Type	-0.0008	0.0004	0.045	7,787
Youth Bulges x Economic Opportunities	-0.0026	0.0006	<0.0005	7,787

Note: The single and squared youth bulge terms have been analyzed jointly.

Countries experiencing armed conflict are not particularly marked by indicators of neo-malthusian population pressure. Conflict-prone countries do not have a significantly different population growth than peaceful countries, not even when population

growth happens in a context of high population density. As argued in Chapter 3, the level of population growth is believed to be highly influenced by the level of development. Since less developed countries are likely to both have high population growth rates and also a high conflict propensity, I find it surprising that the bivariate relationship between population growth rates and armed conflict is not statistically significant. Countries with high population density are, contrary to my expectation, less likely to experience a conflict than more sparsely populated countries. Furthermore, the negative effect on conflict propensity is even stronger when I use a population density measure that takes into account only arable land, relative to the conventional measure based on total land area. Countries hosting large refugee groups have a significantly higher risk of armed conflict, and this is the only indicator of neo-malthusian population pressure that behaves as expected.

My indicator of non-malthusian population pressure, youth bulges, is as expected positive and statistically significant, indicating that countries experiencing conflict do have relatively larger youth cohorts than peaceful countries. The squared term for youth bulges indicates that the effect on conflict propensity is linear, not supporting an expectation that the effect increases with the size of the youth bulge. The bivariate effects of the interaction terms are also promising. Countries experiencing youth bulges have a higher risk of conflict the less democratic they are, although this statistical relationship is rather weak. Countries with youth bulges and economic recession are also particularly conflict prone.

The rest of this chapter is divided into two parts. In the first part I test neo-malthusian hypotheses over a set of multivariate models, while the second is dedicated to a similar testing of youth bulge hypotheses. In both parts I first present the basic models for the two types of population pressure. Then I run the same models for the dependent variable including all conflict onsets, i.e. both conflicts that erupted from a state of peace and conflicts that erupted while the country in question was experiencing an already ongoing conflict. Models analyzing this dependent variable (‘Onset2’) are referred to in the following as including ‘all conflicts’. Finally, I run the models for different decades to see if the effect of population pressure has changed over time. For most models I have calculated exp(β) for the different variables. Exp(β) is also called

odds ratio, and measures the change in odds associated with an increase of one unit of an independent variable, if all other variables are kept constant.

5.1 Evidence for a Neo-Malthusian Conflict Scenario

In Table 5.2 I present the main models covering the relationship between neo-malthusian forms of population pressure and armed conflict. Model 1 includes population pressure indicators along with the most important control variables, measuring the likelihood of domestic armed conflict for all sovereign states and dependent areas.[26] Model 2 includes in addition one intermediary variable and one interaction term.

Indicators of population pressure do not seem to be of great importance for armed conflict in the multivariate model either. In both models, the interaction effect between population growth and density has the expected positive sign, while the separate effects of growth and density[27] are negative, contrary to my expectation.[28] All three variables are however clearly statistically insignificant[29], supporting a null hypothesis that there is no association between neo-malthusian forms of population pressure and the likelihood of armed conflict.

Table 5.2 *Risk of Armed Conflict by Neo-Malthusian Population Pressure Variables 1950–2000, All States and Dependent Areas*

[26] When I restrict the sample to include only sovereign states, it does not seriously alter the effects of any main explanatory variables in any models. The results reported here should then be comparable to those of studies that only analyze sovereign states.

[27] When my population density measure defining population relative to potentially productive land area is replaced by the conventional measure, population over total land area, the effect of population density is still negative and insignificant.

[28] When the interaction term between growth and density is omitted, the separate effects of population growth and density are virtually unchanged.

[29] In prefer to present full p-values rather than levels of significance in my models. The conventional levels of 10%, 5% or 1% certainty of whether a statistical relationship holds for the universe of units are after all casually set, and strict adherence to such levels can potentially lead to the neglect of interesting relationships that do not meet formal criteria for statistical significance. In the text, unless other is stated, statistical significance refers throughout this thesis to p-values below 0.05. In this study I consequently report two-sided tests, although all hypotheses are stated as one-sided.

Explanatory Variables	Model 1 β st.e.	Model 1 *p-value*[a] Exp(β)	Model 2 β st.e.	Model 2 *p-value*[a] Exp(β)
Population Pressure Variables				
Population Growth*	-0.038 (0.063)	*0.549* 0.96	-0.061 (0.068)	*0.374* 0.94
Population Density*	-0.066 (0.053)	*0.216* 0.94	-0.059 (0.053)	*0.267* 0.94
Growth x Density*	0.037 (0.040)	*0.354* 1.04	0.044 (0.043)	*0.306* 1.04
Growth x Infant Mortality Rate*			0.036 (0.092)	*0.700* 1.04
Control Variables				
Total Population	0.248 (0.048)	***<0.0005*** 1.28	0.261 (0.049)	***<0.0005*** 1.30
Dependency	-0.753 (0.365)	***0.039*** 0.47	-0.594 (0.381)	*0.119* 0.55
Infant Mortality Rate*	0.559 (0.118)	***<0.0005*** 1.75	0.626 (0.132)	***<0.0005*** 1.87
Infant Mortality Rate, Squared*	-0.032 (0.111)	*0.773* 0.97	-0.027 (0.121)	*0.824* 0.97
Regime	0.021 (0.014)	*0.127* 1.02	0.021 (0.014)	*0.129* 1.02
Regime, Squared	-0.011 (0.003)	***<0.0005*** 0.99	-0.011 (0.003)	***<0.0005*** 0.99
Missing Regime Data	-0.171 (0.299)	*0.567* 0.84	-0.124 (0.300)	*0.679* 0.88
Economic Opportunities			-0.053 (0.019)	***0.004*** 0.95
Missing Economic Data			-0.250 (0.257)	*0.331* 0.78
Controls for Statistical Dependency				
Previous Conflict	0.074 (0.076)	*0.332* 1.08	0.077 (0.077)	*0.323* 1.08
Brevity of Peace (3 Years)	2.136 (0.300)	***<0.0005*** 8.47	1.984 (0.304)	***<0.0005*** 7.27
Constant	-5.584 (0.466)	***<0.0005*** -	-5.733 (0.481)	***<0.0005*** -
N	7,770		7,770	
Log Likelihood	-819.01		-814.29	
Pseudo R^2	0.132		0.137	

Note: Variables marked with an asterisk have been centered (or standardized) in order to avoid problems of multicollinearity. If parameter estimates are highly intercorrelated (above 0.5) this is an indication of multicollinearity, i.e. the variables are explaining too much of the same variance, making the estimates that are intercorrelated unreliable. When centering a variable, the mean value is subtracted from the value of all units, so that the new mean of the variable is 0. While the scale of the variable is as broad as it was originally, this procedure enables us to separate the effects of the intercorrelated variables. For all the variables that have been centered in this study, a correlation matrix of the original parameter estimates indicated problems of multicollinearity. In all later models, centered variables are marked with an asterisk.

[a] Effects that are significant at 0.05 level in bold.

In Model 2, an interaction term between population growth and infant mortality rate is included to see whether less developed countries that experience high population growth rates are especially conflict prone. This interaction term is included to test

indirectly the ingenuity-hypothesis of Thomas Homer-Dixon. Since countries that are less developed are much more likely to experience a lack of ingenuity than developed countries, they should be more exposed to conflict in the face of population pressure and resource scarcity. But while the sign is positive, this interaction term is also statistically insignificant.[30]

Neo-malthusian theory suggest that one of the most important ways that population pressure increases the likelihood of armed conflict is through its negative effect on economic productivity. When I introduce the economic opportunities variable in Model 2, measuring economic growth, this does not cause much of a change in the effect that population growth has on conflict. Economic opportunities do seem to have a significant effect on conflict propensity though, an increase of one percentage point of annual economic growth is associated with an approximate five percent drop in the risk of having an armed conflict. It does not seem from these results that population pressure is a very important determinant of economic growth.[31]

Most of my control variables are statistically significant in Models 1 and 2, and mostly they also behave as expected. Countries with larger populations are clearly more exposed to the risk of armed conflict than countries with small populations, probably reflecting that countries with many people are also countries with large territories and more fragmented populations. Since the variable is log-transformed, it means that the effect on conflict propensity of an increase of one unit diminishes with larger populations. The parameter estimate in Model 1 suggests that countries with populations of 1 million are almost 80% more likely to experience a conflict than

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[30] Interaction terms between population density and development, and population growth, population density and development produced similar, insignificant results. Also, when the development measure is changed from IMR to GDP per capita, the interaction term between population growth and development is still insignificant.

[31] The evidence for a relationship between population and GDP per capita growth rates is ambiguous. Kelley & Schmidt (1995) argue that scholars generally have failed to find such correlation. In their own study they do find a negative impact of high population growth on economic outcome for less developed countries in the 1980s, but not in the 1960s and 1970s. The data on population and economic growth rates used in the present study have not initially been arranged for an analysis similar to that of Kelley and Schmidt. But when I run linear regression models with economic opportunities as the dependent variable, population growth rates do have a negative and significant effect on GDP per capita growth rates over a broad variety of model specifications. The two growth measures are run for parallel time periods, and the results may thus indicate that population growth has an immediate negative impact on economic growth through an increased dependency burden. As argued in Section 2.1.6, the negative impact that population growth may have on economic growth through a higher dependency burden does not have to operate through natural resource scarcity.

countries with a population of 100,000. Countries with populations of 10 million are only approximately 19% more likely to experience a conflict than countries with 5 million inhabitants.

Political dependency status is negatively related to armed conflict, and the effect is significant at 0.05 level. The dependency variable is strongly correlated with the missing regime data indicator, since the Polity Project does not provide regime scores for dependencies. When I omit the missing indicator from the analysis, the effect of dependency is negative and significant at 0.01 level in Model 1, and borderline significant at 0.05 level in Model 2.[32] Dependencies can thus be viewed as a separate regime category, and they exhibit a lower conflict propensity than sovereign states. In Model 1 dependencies run less than half the risk of conflict compared to sovereign states. The explanation for this relationship is probably that colonial wars have been relatively rare and were primarily a phenomenon of the first half of the period studied here. Most dependencies in the dataset are areas that could have achieved independence by peaceful means, but retain their dependency status out of their own free will. Only two out of the total of 19 conflicts that broke out in dependencies in my dataset, happened after 1975.

My proxy variable for development, infant mortality rates, is strongly significant and positively related to armed conflict in both models, supporting a hypothesis that less developed countries are more likely than more developed countries to experience conflict. While this is consistent with many previous studies using economic development indicators, I fail to find a curvilinear shape.[33] Thus, the less developed a country is, the more prone it is to conflict, although the effect is diminishing for increasing levels of infant mortality (see Figure 5.1). In Model 1, a change in IMR from 200 to 150 corresponds to a reduction in conflict proneness by 15%, while a reduction from 20 to 10 is associated with a risk reduction of more than 30%. If the Sub-Sahara African countries would improve their level of development relative to a reduction in

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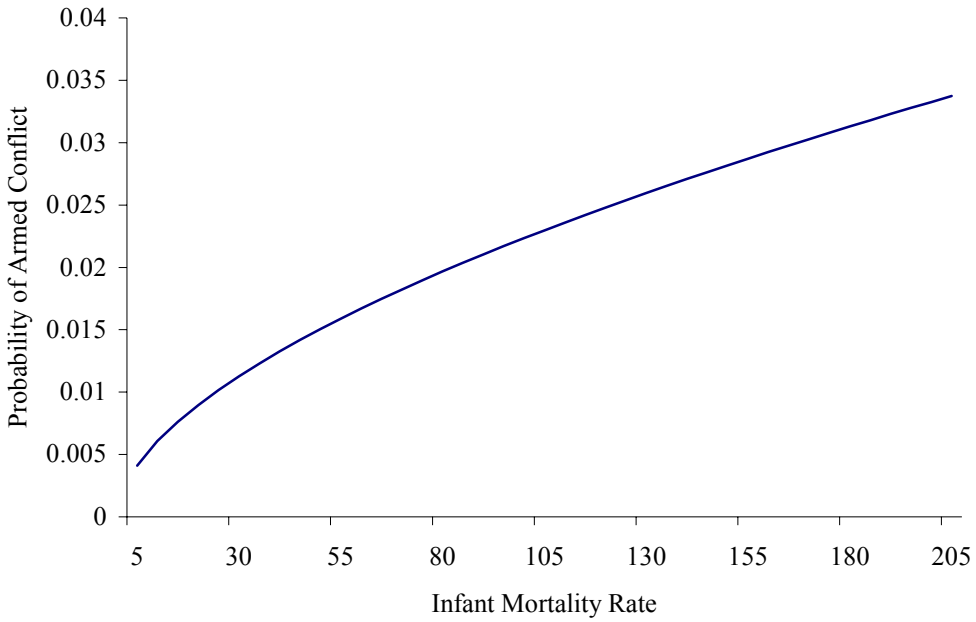
[32] Similarly, the missing-regime indicator is statistically significant and negative when dependency is omitted in model 1.

[33] This finding is consistent over all model specifications presented here, and I will omit the squared term for development in consecutive models.

IMR from their present (2000) level of approximately 90 to the present Western European average level of 6.4, this would reduce their risk of conflict by more than 75%, all other factors being equal.

Figure 5.1 *Probability of Armed Conflict as a Function of Infant Mortality Rate, All Control Variables at Mean*



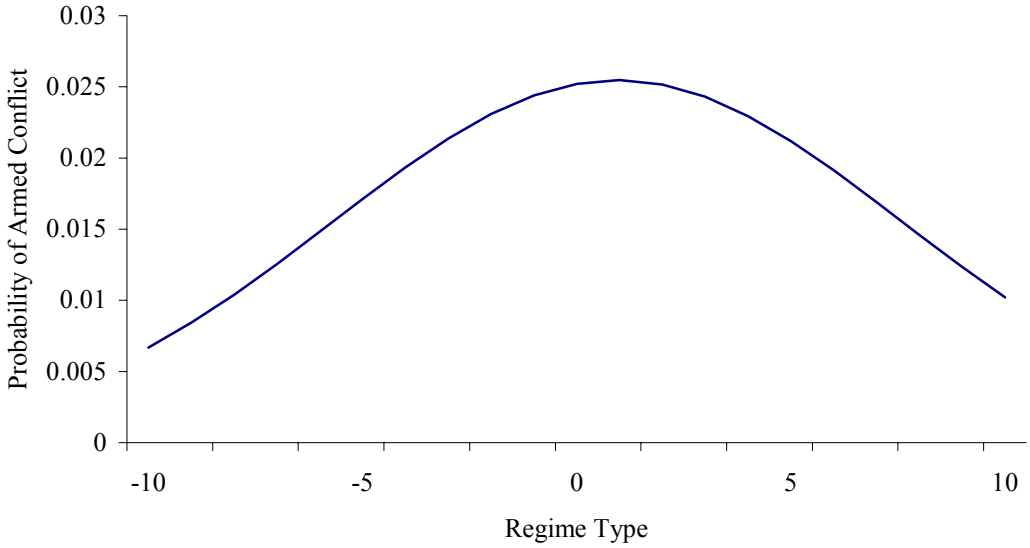
The figure is based on estimates from Model 1 in Table 5.2.

Type of political regime seems to matter for armed conflict, and the effects are consistent with the findings of previous studies.[34] The squared regime term is significant at 0.001 level, suggesting that there is indeed an inversed U-shaped relationship between regime type and conflict, where intermediary regimes are more conflict prone than democracies and autocracies (see Figure 5.2). The curve is not perfectly symmetric around the mean value 0, somewhat surprisingly full-fledged democracies do have a slightly higher risk of conflict than stark autocracies. Countries with the value of +1 on the regime scale are most conflict prone. Compared to the most conflict-exposed

[34] I also ran the models with and alternative democracy scale, the Polyarchy data (Vanhanen, 2000). The results were almost identical to those attained when using the Polity scores, both for the democracy variable itself and for the other independent variables, over all models. The only main difference was that dependencies were set to the lowest score of the Polyarchy scale, 0, since Polyarchy is primarily concerned with electoral institutions. Resulting from this, the separate effect of dependency status vanished.

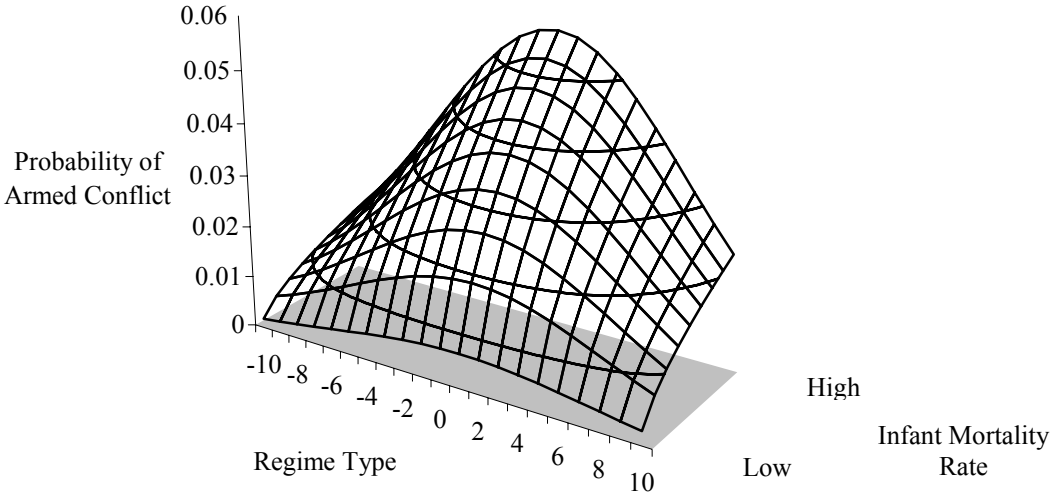
regimes, fully developed democracies (+10) are 60% less likely to experience a conflict, while consistent autocracies (-10) are almost 75% less exposed, all other factors held constant. In Figure 2.3, the infant mortality rate and regime variables are represented jointly.

Figure 5.2 *Probability of Armed Conflict as a Function of Regime Type, All Control Variables at Mean*



The figure is based on estimates from Model 1 in Table 5.2.

Figure 5.3 *Probability of Armed Conflict as a Function of Infant Mortality Rate and Regime Type, All Control Variables at Mean*



The figure is based on estimates from Model 1 in Table 5.2.

The indicator for missing regime data is statistically insignificant when the dependency variable is included, while negative and significant at 0.05 level when the dependency variable is omitted from the analysis. The interpretation of this relationship is that dependent areas, that have been assigned the regime value 0, do have a significantly lower risk of conflict than independent states that originally have the value 0 on the regime variable. Since the effect of the missing indicator diminishes when controlling for dependency status, I conclude that country-years of sovereign states that have been assigned the regime value 0 as a result of missing values do not have a significantly different conflict propensity than countries that are observed to have had a regime value of 0, all other factors held constant. Also, the missing indicator for economic opportunities is not significant, indicating that country-years that have been assigned the mean value do not have a significantly different risk of conflict than country-years that are observed to have had the mean value.

The brevity of peace variable is clearly significant and positively related to conflict; immediately after the secession of an armed conflict, a country is more than 8 times as likely (Model 1) to experience another conflict than countries that experi-

enced conflict a long time ago or that never have experienced a conflict.[35] The parameter estimates of brevity of peace and previous conflicts are intercorrelated on a relatively high level (-0.54 in Model 1), indicating that the reason why the latter variable is statistically insignificant may be that the two variables capture much of the same variance. This is supported by the fact that the previous conflict variable becomes significant at 0.001 level when the brevity of peace variable is omitted from the analysis. It is possible that the separate effects of brevity of peace and previous conflicts would have been more visible in a model covering a longer time span. The results presented in Table 5.1 indicate that the time since last conflict is more important than the number of conflicts that have taken place historically.

Finally, I ran Model 1 with the alternative development measure, a log-tranformed term for GDP per capita (see Model 3, Table 5.3). As many as 2,202 country-years lack information on this variable. Such units were assigned the mean value, and I included a dummy variable taking on the value 1 for originally missing values, and 0 otherwise. GDP per capita performs very similar to IMR as a proxy of development. The term is as expected negatively associated with armed conflict, and I still fail to find any curvilinear effect of development on conflict propensity.

The most interesting change from Model 1 to 3 is that population density has a negative effect on conflict, significant at 0.01 level, when I use GDP per capita as the measure for development. This finding is at odds with that of Hauge & Ellingsen (2001) using the conventional measure for population density. To see whether this disparity in results is due to the different density measures, I replaced my population density measure with theirs. However, the results are almost identical, although the statistical relationship is slightly stronger for my density measure (a p-value of 0.008 versus 0.013 for the conventional measure).

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[35] Beck et al. (1998) have shown that the control for time dependency generally makes it more difficult to obtain statistically significant effects from time-dependent explanatory variables. This is also the experience of this study. The inclusion of the brevity of peace variable has generally increased p-values in all models. And the shorter the half-life period was set to, the more difficult it was to obtain statistically significant results. Since I apply the brevity of peace variable with the shortest half-life, 3 years, this generally strengthens the results obtained in my models.

Table 5.3 *Risk of Armed Conflict by Neo-Malthusian Population Pressure Variables 1950–2000, All States and Dependent Areas, GDP per Capita as Development Measure*

Explanatory Variables	β	st.e.	p-value	Exp(β)
Model 3				
Population Pressure Variables				
Population Growth*	0.015	0.063	0.816	1.02
Population Density*	-0.139	0.052	0.008	0.87
Growth x Density*	0.054	0.052	0.192	1.06
Control Variables				
Total Population	0.267	0.049	<0.0005	1.31
Dependency	-0.501	0.370	0.175	0.61
GDP per Capita*	-0.499	0.126	<0.0005	0.61
GDP per Capita, Squared*	-0.032	0.089	0.719	0.97
Missing GDP Data	0.204	0.248	0.411	1.23
Regime	0.020	0.014	0.141	1.02
Regime, Squared	-0.012	0.003	<0.0005	0.99
Missing Regime Data	-0.254	0.304	0.403	0.78
Controls for Statistical Dependency				
Previous Conflict	0.035	0.076	0.640	1.04
Brevity of Peace (3 Years)	2.196	0.294	<0.0005	8.99
Constant	-5.792	0.472	<0.0005	-
N	8,083			
Log Likelihood	-820.78			
Pseudo R^2	0.138			

* Centered variable.

The results are somewhat surprising as Hauge & Ellingsen find a positive effect of population density on conflict proneness both for high threshold civil war data, and for low intensity armed conflict. And they also use GDP per capita as their measure for development. The main differences between the two studies is that Hauge & Ellingsen categorize their density measure into dummy variables of high, medium and low population density, and only cover a very short period (1989–92 for the armed conflict data) and a relatively small number of countries.

The explanation for why population density is significant in one model but not the other could be that the IMR mirrors some kind of 'advantage' of living in densely populated areas, for instance shorter distance and thus better access to health care services, that the GDP per capita does not. If population density becomes significant in the GDP model because it ignores such developmental issues as health care availability, this is another argument in favor of using IMR as a measure of development.

5.1.1 Consequences of Including Consecutive Conflict Onsets

In Table 5.2 I present the results from models that are identical to Models 1 and 2, with the only exception being the operationalization of the dependent variables. Here, I have included conflicts that broke out when there was already another conflict going on in the same country, and I have added the ongoing conflict in country variable instead of censoring consecutive years of a conflict. The ongoing conflict variable is highly intercorrelated with the brevity of peace variable assuming a half-life of 3 years (a correlation of -0.67 for the original parameter estimates in Model 4). So in Models 4 and 5 the brevity of peace variable assumes a half-life of 16 years, reducing correlation between the parameter estimates to -0.38.

The inclusion of consecutive conflict onsets in Models 4 and 5 do not produce any important changes in the explanatory variables. Neo-malthusian population pressure variables are still insignificant, while population size, dependency status, infant mortality rate, regime type and economic opportunities still prove to be strongly associated with armed conflict. The variable measuring the number of previous conflicts is statistically significant in both models at a 0.001 level, and the parameter estimate suggests that an increase by one conflict in the past is associated with an increased conflict propensity of about 30%. Brevity of peace is still positive and significantly related to conflict, the reduction in odds results primarily from the altered operationalization of this variable.

The most striking result in Models 4 and 5 is the effect of ongoing conflict in country. My expectation was that countries that were already experiencing an armed conflict would be especially likely to experience a subsequent conflict because potential rebel groups might seize the opportunity while the government army was tied up. Instead, the ongoing conflict variable is negatively related to conflict and significant at 0.001 level. In years when a conflict is going on in a country, the risk that the country will see another conflict is only one third of the likelihood that a country in peace will see an armed conflict, all other factors being equal.

Table 5.4 *Risk of Armed Conflict by Neo-Malthusian Population Pressure Variables 1950–2000, All Conflicts, All States and Dependent Areas*

Explanatory Variables	Model 4 β St.e.	Model 4 *p-value*[a] Exp(β)	Model 5 β St.e.	Model 5 *p-value*[a] Exp(β)
Population Pressure Variables				
Population Growth*	-0.052 (0.058)	*0.370* 0.95	-0.078 (0.061)	*0.197* 0.92
Population Density*	-0.061 (0.051)	*0.234* 0.94	-0.050 (0.052)	*0.331* 0.95
Growth x Density*	0.037 (0.039)	*0.338* 1.04	0.046 (0.042)	*0.267* 1.05
Growth x Infant Mortality Rate*			0.044 (0.080)	*0.582* 1.04
Control Variables				
Total Population	0.212 (0.046)	***<0.0005*** 1.24	0.220 (0.047)	***<0.0005*** 1.25
Dependency	-0.960 (0.343)	***0.005*** 0.38	-0.799 (0.360)	***0.026*** 0.45
Infant Mortality Rate	0.602 (0.110)	***<0.0005*** 1.83	0.652 (0.120)	***<0.0005*** 1.92
Regime	0.027 (0.012)	***0.023*** 1.03	0.027 (0.012)	***0.024*** 1.03
Regime, Squared	-0.010 (0.003)	***<0.0005*** 0.99	-0.010 (0.003)	***<0.0005*** 0.99
Missing Regime Data	-0.006 (0.266)	*0.982* 0.99	-0.056 (0.269)	*0.835* 0.95
Economic Opportunities			-0.050 (0.017)	***0.004*** 0.95
Missing Economic Data			-0.124 (0.237)	*0.600* 0.88
Controls for Statistical Dependency				
Previous Conflict	0.273 (0.044)	***<0.0005*** 1.31	0.284 (0.044)	***<0.0005*** 1.33
Brevity of Peace (16 Years)	0.787 (0.221)	***<0.0005*** 2.20	0.695 (0.225)	***0.002*** 2.00
Ongoing Conflict in Country	-1.051 (0.221)	***<0.0005*** 0.35	-1.054 (0.221)	***<0.0005*** 0.35
Constant	-7.860 (0.624)	***<0.0005*** -	-8.042 (0.663)	***<0.0005*** -
N Log Likelihood Pseudo R^2	8,691 -959.78 0.132		8,691 -955.29 0.136	

[a] Effects that are significant at 0.05 level in bold.
* Centered variable.

When only considering the frequencies of conflict onset however, 4.2% of the years in conflict experience a subsequent conflict onset, while only 2.5% of all country-years in peace experience conflict onset. The reason for the higher risk of conflict onset in a state of conflict is due to the accumulation of other conflict-generating factors in these country-years, and not to opportunities to rebel caused by an already on-

going conflict. The reason why the separate effect of ongoing conflict in country is negatively related to conflict may have a substantial explanation, or it may have a methodological explanation relating to the data collection procedures. A substantial explanation could be that when a country is experiencing an armed conflict, this actually reduces the opportunities for other rebel groups to act militarily on the government. First, since the army is already mobilized, a government is able to crack down on subsequent rebel attempts much faster than they would be able to do from a state of peace. Second, governments of countries that experience an ongoing conflict will probably be likely to increase surveillance of potential rebel elements and to strengthen overall security efforts. Third, observing the negative effects of the ongoing conflict may act as a deterrent to the initiation of another.

A methodological explanation for this unexpected relationship could be that conflict onsets from a state of ongoing conflict are underreported. This could happen if the actions of different rebel groups fighting for different causes are seen as part of the same insurgency. It may be difficult to categorize loosely organized alliances of rebel groups fighting a government for different reasons, but in a more or less coordinated way. Are the efforts made by the different groups to be counted as one armed conflict, or several separate ones? Especially, one could expect that in small countries that only have 'space for' one conflict at a time, a spread of conflict to new groups or areas would be coded as an escalation of the ongoing conflict rather than as a separate conflict. Large countries are more likely to have space for several independent conflicts. Since the ongoing conflict variable is so strongly significant and the effect so large, I believe however that the substantial explanation is the most likely, and that the separate effect of experiencing an ongoing conflict actually make countries less conflict prone.[36]

[36] If the methodological explanation should be correct, I would have expected that consecutive conflicts in small countries were more likely to be categorized as part of an ongoing conflict, while larger countries would have sufficient 'space' for several independent conflicts. However, an interaction effect between ongoing conflict in country and total population size is statistically insignificant in Model 4. This supports a substantial explanation.

5.1.2 A Golden Age of Neo-Malthusianism?

As previously mentioned, Kelley & Schmidt (1995) have found that population growth has influenced the level of economic output negatively in some time periods, but not in others (the 1980s versus the 1960s and 1970s respectively). As the neo-malthusian argument is that population growth may reduce economic productivity and thereby provide grievances that can trigger armed conflict, I wanted to test whether indicators of neo-malthusian population pressure performed differently over time, perhaps disclosing a neo-malthusian golden age. This will also reveal whether there is any empirical support for the expectation of a rise in conflict propensity in the 1990s following from neo-malthusian root causes.

Of course, running models for different time periods do not provide any information about what factors that contribute to make some variables more or less important for armed conflict over time. Structural or ideological factors may contribute to increase or decrease the effect of some variables over time. A possible detection of significant effects specific to certain time periods would then be an incentive for further research aimed at revealing factors that are unobserved in the current model. If statistically significant effects are detected for certain time periods, they are likely to be credible indicators of causal effects as the total variance in models covering a shorter time period is much smaller than in the overall models.

Breaking my model down on decades certainly reveals some interesting results. The only evidence that I find for neo-malthusian claims is that the interaction term between population growth and density is positive and significant for the 1970s. Thus, in the decade that really saw the explosion of neo-malthusian literature, countries with high population growth that already experienced a high population density did actually have a higher risk of armed conflict, other factors being equal. This finding is very robust over a broad set of model specifications. I have not been able to find an adequate explanation for why countries should be more exposed to neo-malthusian conflict factors in the 1970s.

Table 5.5 *Risk of Armed Conflict by Neo-Malthusian Population Pressure Variables and Decades 1950–2000, All States and Dependent Areas*

Explanatory Variables	**Model 6 1950–59**	**Model 7 1960–69**	**Model 8 1970–79**	**Model 9 1980–89**	**Model 10 1990–2000**	**All Decades**
Population Pressure Variables						
Population Growth* β	0.026	0.077	-0.062	0.027	-0.083	-0.034
st.e.	(0.254)	(0.196)	(0.097)	(0.127)	(0.084)	(0.062)
p-value[a]	*0.919*	*0.692*	*0.523*	*0.831*	*0.322*	*0.584*
Population Density*	0.011	-0.252	-0.060	-0.158	-0.013	-0.065
	(0.137)	(0.137)	(0.117)	(0.140)	(0.099)	(0.053)
	0.934	***0.066***	*0.606*	*0.259*	*0.897*	*0.219*
Growth x Density*	-0.015	0.062	0.138	-0.068	0.048	0.036
	(0.095)	(0.102)	(0.056)	(0.086)	(0.070)	(0.040)
	0.871	*0.541*	***0.014***	*0.430*	*0.495*	*0.358*
Refugees[b]	-	-	-	-	0.511 (0.326) *0.117*	-
Control Variables						
Total Population	0.380	0.398	0.269	0.193	0.244	0.248
	(0.135)	(0.127)	(0.111)	(0.129)	(0.102)	(0.048)
	0.005	***0.002***	***0.016***	*0.134*	***0.016***	***<0.0005***
Dependency[c]	-0.459	-0.903	-0.474	-	-	-0.763
	(0.828)	(0.673)	(0.981)			(0.363)
	0.580	*0.180*	*0.629*			***0.036***
Infant Mortality Rate	0.245	1.234	1.082	0.911	0.642	0.558
	(0.461)	(0.409)	(0.299)	(0.314)	(0.209)	(0.117)
	0.595	***0.003***	***<0.0005***	***0.004***	***0.002***	***<0.0005***
Regime	-0.013	0.033	0.050	0.069	-0.006	0.020
	(0.043)	(0.036)	(0.030)	(0.031)	(0.026)	(0.014)
	0.768	*0.351*	***0.097***	***0.026***	*0.807*	*0.132*
Regime, Squared	-0.014	-0.001	-0.001	-0.010	-0.017	-0.011
	(0.009)	(0.007)	(0.006)	(0.008)	(0.006)	(0.003)
	0.116	*0.849*	*0.827*	*0.217*	***0.003***	***<0.0005***
Missing Regime Data	0.113	1.516	0.394	1.154	-1.585	-0.176
	(0.845)	(0.660)	(0.756)	(0.883)	(0.553)	(0.298)
	0.893	***0.022***	*0.602*	*0.862*	***0.004***	*0.554*
Controls for Statistical Dependency						
Previous Conflict	0.509	0.005	0.230	0.236	-0.248	0.077
	(0.671)	(0.309)	(0.195)	(0.159)	(0.132)	(0.075)
	0.448	*0.987*	*0.238*	*0.138*	***0.061***	*0.308*
Brevity of Peace (3 Years)	1.333	1.886	0.805	0.810	2.949	2.131
	(1.426)	(0.950)	(0.821)	(0.888)	(0.465)	(0.300)
	0.350	***0.047***	*0.327*	*0.361*	***<0.0005***	***<0.0005***
Constant	-8.105	-13.295	-10.650	-8.741	-7.430	-7.833
	(2.304)	(2.299)	(1.776)	(2.005)	(1.329)	(0.669)
	<0.0005	***<0.0005***	***<0.0005***	***<0.0005***	***<0.0005***	***<0.0005***
N	1,483	1,581	1,520	1,426	1,760	7,770
Log Likelihood	-116.27	-147.75	-164.49	-138.58	-220.14	-819.06
Pseudo R^2	0.138	0.158	0.128	0.117	0.218	0.132

[a] Variables that are statistically significant at 0.10 level in bold.
[b] Data on refugees are only available for the 1990s.
[c] For the periods 1980–89 and 1990–2000, no dependent country-years that were analyzed experienced an armed conflict onset, thus the dependency variable is omitted from the analysis for these periods.
* Centered variable.

High population density is found to have reduced the risk of conflict in the 1960s. This finding is very robust at 0.10 level over different model specifications, and is borderline significant at 0.05 level in Model 7. There is no significant effect of population density in any other decade, but the sign is negative for all periods except the 1950s. These results provide further evidence for the cornucopian view that densely populated countries are less conflict prone. When I replace my density measure with the conventional one, however, the variable turns statistically insignificant also for the 1960s.

The third of my neo-malthusian indicators of population pressure, large refugee populations, is only tested for the period 1990–2000 due to data availability. The variable has a positive sign, and is almost statistically significant at 0.10 level in this model. Since my refugee variable is a very rough indicator of population pressure following from migration, a more detailed analysis concerned with possible links between migratory behavior and conflict would do more justice to this assumed relationship.

The control variables behave very much like in Model 1, although it is more difficult to achieve statistical significance over a decade because the variance for each of the decades is much smaller than in the overall model. This is especially the case with the 1950s, the decade with the smallest number of country-years, and also the smallest relative number of conflict onsets. Generally, my basic model (as it is presented in Model 1) seems to have the greatest explanatory power for the 1990s, with an explained variance (pseudo R^2) almost the double that of the 1980s.

The total population size and infant mortality rate variables are the most commonly significant in the period models, always positively related to conflict. The inverse U-shaped relationship between democracy and conflict is only significant for the last period. For the 1970s and 80s the regime variable predicts a more linear effect, somewhat surprisingly with the risk of conflict increasing with the level of democracy. For the first two decades, none of the regime terms are statistically significant, although the squared regime term is almost significant at 0.10 level for the 1950s. But these results do not necessarily undermine the democratic peace argument. The squared regime term has the expected negative sign for all decades. I assume that the

lack of statistical significance for the squared term for the decades from the 1950s to the 1980s is due to the low number of units studied for each decade, rather than evidence for a different causal pattern.

The brevity of peace variable is only significant for two periods. The reason for this is probably the relatively short period studied here. Since we do not know about conflict history prior to 1950, this variable is probably severely underestimated for the first periods. The other control variable for time dependency, previous conflict, is only significant in the last period, but the direction of the effect was somewhat surprising. I assumed that this effect was spurious, and its significance due to the many successor states of the Soviet Union and the Federal Republic of Yugoslavia that entered the dataset in the first half of the 1990s, many of which burst more or less straight into armed conflict. This proved to be correct. When I control for communist state dissolution in Model 10, the variable for previous conflict turns statistically insignificant. The communist state dissolution variable is significant at 0.05 level.

The last point that deserves to be commented on in this section is the negative and clearly significant effect of the missing regime data indicator for the 1990s. To see whether it just captured the lower conflict risk experienced by dependent areas as the dependency variable was omitted in this model, I ran a separate model only for sovereign states. However, the missing regime indicator performed almost exactly identically. This indicates that sovereign states that were assigned the Polity score 0 in the 1990s did have a significantly lower risk of conflict than states that actually had the score 0. This could be due to increasing democratization in the 1990s compared to previous decades. While it seems as if assigning the mean value for the missing values for some of the control variables generally does not violate the actual distribution of each of these variables, the mean value is not a good indicator of the actual distribution for countries lacking information on the regime variable in the 1990s.

5.1.3 Summarizing the Support for Neo-Malthusian Hypotheses

The neo-malthusian hypotheses (Hypotheses 1–4) do not receive much support in the models tested here. Hypothesis 1 receives no support at all; overall population growth

in a country does not seem to influence the risk of that country to experience armed conflict. Furthermore, I have not been able to detect any effect of population growth through the assumed intermediary relationship with economic growth. While the latter variable clearly influences the risk of conflict, there is no unambiguous relationship between population growth and economic growth.

The lack of relationship between population growth and conflict seems to hold for countries at all levels of development; there is no evidence that less developed countries experience higher risks of conflict following from population growth. This runs counter to Homer-Dixon's ingenuity hypothesis presented in Section 2.1.5. Homer-Dixon himself argues that it is impossible to quantify ingenuity. However, the three factors that Homer-Dixon believes are especially limiting ingenuity, failed market mechanisms, social friction and shortages of financial and human capital, are far more present in developing than in developed countries, and more so the less developed a country is. If social ingenuity were the key to explain neo-malthusian conflict, the interaction between population growth and development should have produced significant results.

I have found no evidence supporting Hypothesis 2. Rather, I have found some support for an alternative cornucopian hypothesis, assuming that high population density is a source to better economic performance and thus is likely to reduce the risk of armed conflict. Cornucopians argue that countries with high population density have advantages over less densely populated areas related to for instance better communication systems and greater economic efficiency due to large-scale and centralized production. These advantages are believed to lead to better economic performance that in turn could reduce the risk of conflict.

I found that high population density reduced the likelihood of armed conflict in the 1960s. Also, when using GDP per capita as the measure of development, population density has a negative and significant effect on conflict propensity for the whole period studied. I do however suspect that GDP per capita fails to capture aspects about population density that relates to developmental issues, such as access to health care. The results are nevertheless the opposite of those obtained in the study by Hauge & Ellingsen (2001), even when applying the same measure for density as they do. The

research designs are quite similar. The differing results may be explained by the longer period and the larger number of countries in this study, possibly along with the use of density as a continuous measure in this study compared to the categorization of levels of density in the Hauge & Ellingsen study.

By operationalizing population density relative to arable land, I assumed that I had established a measure that was a more valid indicator of neo-malthusian population pressure than the conventional measure including all land. But the two measures have performed very similarly. As discussed in Section 4.5.3, I am not confident that I have been able to establish a very reliable measure of arable land, and this could be reason for the small deviation in results. However, in Models 3 and 7 where I have used both density measures, the improved density measure is actually slightly more strongly related to a reduction in conflict proneness than the conventional one. This confirms the finding from the bivariate analyses. Since I assumed that a measure that was more sensitive towards agricultural production would make it easier to achieve *positive* effects of density on conflict, this result further undermines the neo-malthusian position.

Some limited evidence for Homer-Dixon's theory is found for Hypothesis 3. Countries that experienced both high population growth and high population density in the 1970s did have a significantly higher risk of conflict, but only in this decade. It is intriguing that this finding coincides with the rise of neo-malthusian literature. More likely than being a self-fulfilling prophecy, it could be that the increased concern over population and environmental issues in the 1970s mirrored an increase in neo-malthusian conflicts in that decade. The interaction term between population growth and density is clearly insignificant in all models for the other time periods, and for two of these periods the sign is in the opposite direction. I assumed in Section 2.1.7 that this measure was the most valid indicator of neo-malthusian population pressure. The general lack of statistical significance for relationships between the interaction measure and armed conflict seriously weakens the neo-malthusian conflict scenario.

Empirical support for Hypothesis 4, predicting an increased risk of conflict following from large refugee populations, is ambiguous. The effect on conflict propensity of hosting large refugee groups is positive, and almost statistically significant at 0.10

level. As argued in the previous section, the measure employed here is very crude, and data on refugees are generally unreliable. Better data for a longer period might have produced more significant results, and the relationship between refugee populations and armed conflicts should be investigated further. However, a positive and significant relationship between the two would not necessarily provide support for neo-malthusian theory. Refugee populations need not be the result of resource scarcity, nor do they necessarily produce scarcity in the area of arrival. Furthermore, the refugee variable may just proxy geographical proximity to a country experiencing armed conflict. Thus, the variable may actually measure a spillover effect of conflict across borders that need not be related to the refugee populations themselves.[37]

5.2 Do Youth Bulges Make Countries More Conflict Prone?

In Table 5.6 I test whether population pressure in the form of youth bulges make countries more conflict prone. Models 11 and 12 include the same control variables as Model 1. Since it has been suggested that youth bulges above a certain size make countries especially conflict prone, I have included a squared term. The results in Models 11 and 12 do support a hypothesis that large youth bulges increase the risk of armed conflict. And apparently, Huntington's argument that youth bulges above a certain level make countries especially conflict prone, receives some support in Model 11. The positive and significant effect of the squared term suggests that the larger youth bulges, the more does the risk of conflict increase. The effects of the control variables are very similar to Model 1.

Table 5.6 *Risk of Armed Conflict by Youth Bulges 1950–2000, All States and Dependent Areas*

Explanatory Variables	**Model 11** β st.e.	*p-value*[a] Exp(β)	**Model 12** β st.e.	*p-value*[a] Exp(β)
Population Pressure Variables				
Youth Bulges*	0.030	*0.095*	0.049	***0.011***

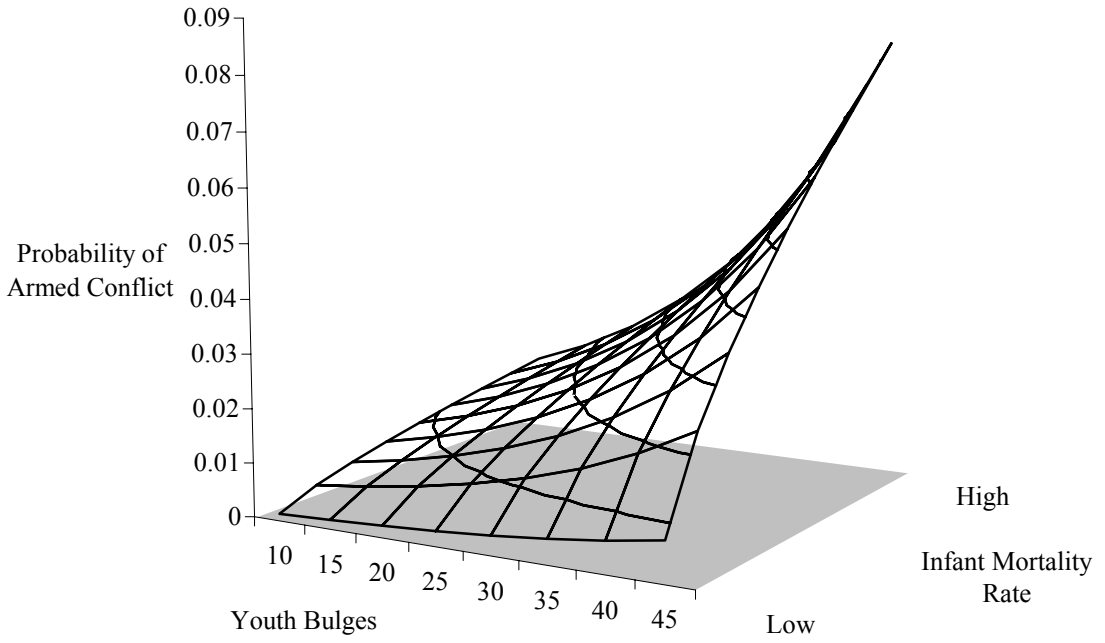
[37] However, Hegre et al. (2001: 39) do not find any significant effect on conflict propensity of an ongoing neighboring war.

	(0.018)	1.03	(0.019)	1.05
Youth Bulges, Squared*	0.005 (0.002)	***0.036*** 1.01	0.003 (0.002)	*0.137* 1.003
Control Variables				
Communist State Dissolution			2.039 (0.430)	***<0.0005*** 7.68
Total Population	0.258 (0.050)	***<0.0005*** 1.29	0.268 (0.050)	***<0.0005*** 1.31
Dependency	-0.533 (0.354)	*0.132* 0.59	-0.552 (0.355)	*0.120* 0.58
Infant Mortality Rate*	0.583 (0.144)	***<0.0005*** 1.79	0.628 (0.147)	***<0.0005*** 1.87
Regime	0.021 (0.014)	*0.114* 1.02	0.025 (0.014)	*0.069* 1.03
Regime, Squared	-0.010 (0.003)	***<0.0005*** 0.99	-0.008 (0.003)	***0.005*** 0.99
Missing Regime Data	-0.166 (0.297)	*0.576* 0.85	-0.026 (0.299)	*0.930* 0.97
Controls for Statistical Dependency				
Previous Conflict	0.065 (0.078)	*0.407* 1.07	0.088 (0.078)	*0.259* 1.09
Brevity of Peace (3 Years)	2.095 (0.301)	***<0.0005*** 8.13	1.901 (0.303)	***<0.0005*** 6.69
Constant	-5.901 (0.494)	***<0.0005*** -	-6.134 (0.502)	***<0.0005*** -
N	7,658		7,658	
Log Likelihood	-827.70		-818.95	
Pseudo R^2	0.130		0.139	
[a] Effects that are significant at 0.05 level in bold. * Centered variable.				

As argued in Section 4.5.6, I suspected that this curvilinear pattern is due to the many conflicts in the successor states of the Soviet Union and Yugoslavia in the first half of the 1990s. At that time these states had very small youth cohorts. There is little reason to think that the conflicts in post-communist societies were partly attributed to their relatively small youth cohorts, and I thus believe that causes of these conflicts are not captured very well in the present model. To control for unobserved explanatory variables I add a dummy variable for communist state dissolution (Model 12), taking the value 1 for all successor states for five years after the dissolution of the Soviet Union and the Federal Republic of Yugoslavia. The dummy variable is clearly significant and positive, indicating that there are certainly causes of the conflicts in post-communist states that are not captured in my model. The squared term for youth bulges is insignificant in Model 12, leaving the single term for youth bulges significant and positive. An increase in youth bulges of one percentage point is associated with an

increased risk of conflict of 5%, other factors being equal. In Figure 5.4, the youth bulge and development variables are represented jointly.

Figure 5.4 *Probability of Armed Conflict as a Function of Youth Bulges and Infant Mortality Rate, All Control Variables at Mean*



The figure is based on estimates from Model 12 in Table 5.6.

As argued in Section 4.5.5, I believe that the operationalization of the youth bulge variable is of great importance. When my youth bulge variable is replaced in Models 11 and 12 with one measuring youth cohorts relative to the total population as done by Collier and associates (Collier, 2000; Collier & Hoeffler, 2002a), this results in insignificant effects of youth bulges in both models. An erroneous operationalization of this variable can thus hide the role that large youth cohorts play in armed conflicts. This may be why Paul Collier and associates fail to find strong effects of youth bulges on conflict propensity.

Table 5.7 *Risk of Armed Conflict by Youth Bulges 1950–2000, All States and Dependent Areas, GDP per Capita as Development Measure*

Explanatory Variables	β	st.e.	p-value	Exp(β)
Model 13				
Population Pressure Variables				
Youth Bulges*	0.070	0.018	<0.0005	1.07
Youth Bulges, Squared*	0.001	0.002	0.626	1.001

Control Variables				
Communist State Dissolution	1.898	0.448	<0.0005	6.67
Total Population	0.278	0.050	<0.0005	1.32
Dependency	-0.214	0.360	0.552	0.81
GDP per Capita*	-0.349	0.106	0.001	0.71
Missing GDP Data	-0.020	0.254	0.938	0.98
Regime	0.021	0.014	0.125	1.02
Regime, Squared	-0.009	0.003	0.002	0.99
Missing Regime Data	-0.102	0.300	0.733	0.90
Controls for Statistical Dependency				
Previous Conflict	0.030	0.076	0.692	1.03
Brevity of Peace (3 Years)	2.052	0.294	<0.0005	7.78
Constant	-3.366	0.968	0.001	-
N	7,787			
Log Likelihood	-822.98			
Pseudo R^2	0.138			

* Centered variable.

The high correlation between the IMR and youth bulge variables described in Section 4.5.6 indicated that there could be a multicollinearity problem. But as these variables have been standardized in Models 11 and 12, the problem seems to be marginal. A correlation matrix of the parameter estimates of Model 12 shows that the correlation between the IMR and youth bulge estimates is well below 0.5 (Appendix 3). But to further counter allegations that my use of IMR to proxy development makes the youth bulge measure unreliable, I ran a model identical to Model 12 with GDP per capita as the development measure (Model 13). The only difference of such a procedure is that the effect of youth bulges is now significant at <0.0005 level, and the effect of a change on this variable is even stronger than in Model 12. An increase in the youth bulge variable of one percentage point is now associated with an increase in conflict propensity of more than 7%. A correlation matrix of the parameter estimates for this alternative model specification shows a relatively low correlation between the youth bulge and GDP per capita estimates (Appendix 4).

If youth bulges increase the likelihood of conflict, can we say anything about how and why they matter? In Model 14 presented in Table 5.8 I include two interaction terms aimed at testing Hypotheses 6 and 7, arguing that youth bulges increase the risk of conflict especially under conditions of economic recession and autocratic regimes.

Table 5.8 *Risk of Armed Conflict by Youth Bulges and Interactions 1950–2000, All States and Dependent Areas*

Explanatory Variables	β	st.e.	p-value	Exp(β)
Model 14				
Population Pressure Variables				
Youth Bulges*	0.042	0.020	0.036	1.04
Regime x Youth Bulges*	-0.0003	0.002	0.916	1.00
Economic Opportunities x Youth Bulges*	0.006	0.003	0.086	1.01
Control Variables				
Communist State Dissolution	2.312	0.487	<0.0005	10.09
Total Population	0.264	0.051	<0.0005	1.30
Dependency	-0.424	0.370	0.252	0.65
Infant Mortality Rate*	0.589	0.139	<0.0005	1.80
Regime*	0.031	0.014	0.030	1.03
Regime, Squared*	-0.009	0.003	0.005	0.99
Missing Regime Data	-0.005	0.302	0.988	1.00
Economic Opportunities*	-0.022	0.020	0.285	0.98
Missing Economic Data	-0.264	0.253	0.295	0.77
Controls for Statistical Dependency				
Previous Conflict	0.081	0.078	0.302	1.08
Brevity of Peace (3 Years)	1.875	0.299	<0.0005	6.52
Constant	-5.957	0.496	<0.0005	-
N	7,658			
Log Likelihood	-816.61			
Pseudo R^2	0.142			

* Centered variable.

The interaction term between economic opportunities and youth bulges is relatively close to being statistically significant at 0.05 level, and the sign is positive as expected. Even though this statistical relationship is weak it may indicate that economic issues influence the conflict propensity of large youth cohorts. The economic opportunities variable applied here is a rather crude measure. A measure that capture more specifically the economic hardship of young generations, such as youth unemployment rates, might have fared better. The interaction term between youth bulges and regime type is far from statistically significant, indicating that the effect of youth bulges does not vary with level of democracy.[38]

[38] The lack of relationship holds when I introduce a squared interaction term to see whether youth bulges increase the risk of conflict more in intermediary regimes.

5.2.1 Including Consecutive Conflicts Onsets

In Model 15 the dependent variable also includes conflict onsets that erupted from a state of armed conflict. This is one of the very few models that I have run that do not yield statistically significant effects of youth bulges. All control variables behave as expected, more or less identical to the effects in Models 4 and 5, including the ongoing conflict variable.

Table 5.9 *Risk of Armed Conflict by Youth Bulges, All Conflicts 1950–2000, All States and Dependent Areas*

Explanatory Variables	β	st.e.	p-value	Exp(β)
Model 15				
Population Pressure Variables				
Youth Bulges*	0.029	0.018	0.118	1.03
Youth Bulges, squared*	0.003	0.002	0.206	1.00
Control Variables				
Communist State Dissolution	2.400	0.385	<0.0005	11.02
Total Population	0.220	0.047	<0.0005	1.25
Dependency	-0.779	0.334	0.020	0.46
Infant Mortality Rate *	0.728	0.136	<0.0005	2.07
Regime*	0.035	0.012	0.004	1.04
Regime, Squared*	-0.007	0.003	0.007	0.99
Missing Regime Data	0.134	0.267	0.617	1.14
Controls for Statistical Dependency				
Ongoing Conflict in Country	-1.105	0.220	<0.0005	0.33
Previous Conflict	0.285	0.044	<0.0005	1.33
Brevity of Peace (16 Years)	0.706	0.220	0.001	2.03
Constant	-5.865	0.473	<0.0005	-
N	8,594			
Log Likelihood	-955.62			
Pseudo R^2	0.142			

* Centered variable.

It may be that an endogeneity problem causes the youth bulge effect to turn statistically insignificant in Model 15. Periods of serious armed conflict tend to thin out the cohorts of men at military age, ages that for most countries would be within what I define as youth cohorts. However, an attempt to model for such endogeneity through an interaction effect between youth bulges and ongoing conflict was not entirely successful. While the interaction effect itself was not statistically significant in Model 15, the introduction of the term resulted in a borderline significant effect of youth bulges.

This may be an indication of a slight endogeneity problem.[39] When using GDP per capita as the measure for development instead of IMR in Model 15, the effect of youth bulges is however clearly significant. But the size of the parameter estimate is reduced from previous models.

5.2.2 Effects of Youth Bulges Over Time

In this section, only the model for the 1990s is presented. For all the decades up to this, the effect of youth bulges is positive, but insignificant, and the results of the control variables do not differ substantially from those presented in Models 6–10. For the 1990s however, there is a significant and negative effect of youth bulges (Model 16). But as illustrated in Model 17, this effect turns insignificant when controlled for communist state dissolution.

As argued in Section 5.1.2, to find significant effects when analyzing separate decades is difficult since the total variance is much smaller in each model. So the non-results for youth bulges in models broken down on decades indicate that youth bulges are not as strongly related to armed conflict as are control variables like population size, infant mortality rate and regime type. When I replace IMR with GDP per capita as the development measure, I do find significant and positive effects of youth bulges in the 1960s and 70s, while there is no significant negative effect of youth bulges for the 1990s even before controlling for communist state dissolution.

Table 5.10 *Risk of Armed Conflict by Youth Bulges 1990–2000, All States and Dependent Areas*

	Model 16			**Model 17**		
Explanatory Variables		1990–2000			1990–2000	
	β	st.e.	p-value	β	st.e.	p-value
Population Pressure Variable						
Youth Bulges*	-0.066	0.034	0.051	-0.037	0.037	0.321
Control Variables						
Communist State Dissolution				1.080	0.518	0.037

[39] An interaction effect between ongoing conflict in country and IMR is borderline significant in model 14, indicating that the endogeneity problem may be more severe for infant mortality than for youth bulges.

Total Population	0.274	0.092	0.003	0.281	0.094	0.003
Infant Mortality Rate	1.052	0.298	<0.0005	1.045	0.307	0.001
Regime*	0.005	0.026	0.853	0.006	0.026	0.807
Regime, Squared*	-0.019	0.006	0.001	-0.017	0.006	0.005
Missing Regime Data	-1.256	0.488	0.010	-1.068	0.497	0.032
Controls for Statistical Dependency						
Previous Conflict	-0.198	0.130	0.127	-0.151	0.130	0.244
Brevity of Peace (3 Years)	2.734	0.450	<0.0005	2.526	0.459	<0.0005
Constant	-9.039	1.521	<0.0005	-9.312	1.564	<0.0005
N	1,729			1,729		
Log Likelihood	-227.13			-225.09		
Pseudo R^2	0.208			0.215		

* Centered variable.

5.2.3 Summarizing the Support for Youth Bulge Hypotheses

While evidence is scarce for a neo-malthusian conflict scenario, it is convincingly strong for Hypothesis 5 arguing for a causal relationship between youth bulges and armed conflict. In almost all models that I have run, youth bulges do increase the likelihood of conflict. But I have not found substantial evidence for Huntington's argument that youth bulges above a certain size make countries especially conflict prone. Initially I expected that the use of infant mortality to proxy development would tap some of the effect of youth bulges. This seems to be correct as models run with GDP per capita as the development indicator yield even stronger and more significant effects of youth bulges.

As argued above, the results obtained in the models that include all conflicts indicate that especially demographic factors are likely to be influenced by an ongoing conflict. One major finding when including all conflicts was that the effect of youth bulges was no longer statistically significant. But it is not possible to say from this study if the change in effect is actually reflecting different causal relationships for the two conflict transition types. It could also very well be that I have not been able to measure the exact point in time when demographic changes occur during an armed conflict, so that the effect of demographic variables on consecutive conflicts are not measured correctly.

I have not been able to find convincing empirical evidence for the mechanisms that cause youth bulges to increase the risk of conflict. I have found some evidence for

Hypothesis 6, assuming that youth bulges are more likely to cause armed conflict under conditions of economic recession. This statistical relationship is found to be quite weak, and measures that capture economic conditions that concern youth more directly than overall economic growth may produce stronger effects. I did not find any evidence for Hypothesis 7 that youth bulges would be more likely to cause conflict in autocratic regimes.

6. Conclusion

Claims proliferate that certain demographic characteristics make countries more prone to armed conflict. The aim of this study has been to test empirically whether two types of population pressure, a neo-malthusian pressure on natural resources and a youth bulge pressure on social institutions, are related to armed conflict. I have found that the devil is in parts of the demographics, but not in the parts that have received the most attention.

A main reason for concerns over the demographics is that the world over the past century has experienced a growth in population greater than any other time in history, presumably straining the carrying capacity of the world's natural resources. Are we able to feed the ever-increasing world population? Does population pressure cause an over-exploitation of natural resources in general, leading to large-scale and irreversible environmental degradation? Concerns over the consequences of the growing world population became a major academic issue in the 1970s. In the 1990s, demographic and environmental factors were increasingly regarded as security issues.

Those who argue for a relationship between population, environment and armed conflict are generally referred to as neo-malthusians. Among them, one of the most influential has been Thomas Homer-Dixon, who argues that population growth is an important source of natural resource scarcity. Homer-Dixon believes that some societies lack what he calls social ingenuity and are not able to adapt to increased resource scarcity. These societies are likely to perform worse in terms of food production and economic development, and will thus have an increased risk of domestic armed conflict. Neo-malthusian claims are countered by a school of resource optimists, or cornucopians. They argue that population pressure on resources forces societies to develop and implement new technology, and that this in turn triggers economic development.

The debate over the role of population pressure on natural resources has given rise to a debate over other potential linkages between demographic change and conflict propensity. While rejecting the traditional neo-malthusian claim that overall population growth is the problem, Jack Goldstone argues that large youth bulges is the kind

of population pressure that influences the risk of armed conflict most. Youth bulges are not associated with natural resource scarcity. Rather, Goldstone expects youth bulges to increase the risk of armed conflict when employment opportunities and recruitment to political elite positions, especially for well-educated youth, are limited.

Based on the theoretical work of Thomas Homer-Dixon and Jack Goldstone, I derived a set of empirically testable hypotheses on relationships between indicators of population pressure and armed conflict. I tested the hypotheses over a number of event history models using conflict data with a low threshold for violence. I also analyzed causes of conflicts for different decades in order to investigate whether population pressure variables have become more important after the end of the Cold War.

An overall conclusion from my empirical analysis is that the devil is not in the neo-malthusian understanding of population pressure. Homer-Dixon most often refers to population growth when addressing population pressure, but the level of population growth in a country is not significantly related to armed conflict in any of my models. While also insignificant in most models, population density affects conflict propensity under some conditions. But the effect is the opposite of the neo-malthusian expectation; high population density is associated with a drop in the risk of armed conflict, and even slightly more so when population density is measured as the ratio between population and arable land. A third indicator of neo-malthusian population pressure, large refugee populations, is insignificantly related to conflict.

I have argued that both population growth and population density have shortcomings as indicators of population pressure on natural resources. The variable that I see as the most valid indicator of population pressure on natural resources is the interaction between the two; countries with high population density experiencing high population growth should be the most likely to experience natural resource scarcity. However, even this indicator is insignificant in all models but the one for the 1970s. Perhaps the rise of neo-malthusian literature in 1970s reflects a stronger effect of population pressure on conflict propensity in that decade. Finally I found that less developed countries are no more likely to experience a positive relationship between neo-malthusian population pressure and armed conflict.

The overall conclusion regarding the other form of population pressure is that youth bulges increase the risk that a country will experience armed conflict. This is where the devil is in the demographics. My youth bulge variable has been positive and significantly related to conflict under nearly all model specifications, and the finding is thus very robust. But I have not found any evidence for the claim made by Samuel P. Huntington that youth bulges above a certain critical level makes countries especially conflict prone. My analysis further shows that the operationalization of the youth bulge variable matters a lot. When youth bulges are defined relative to total rather than the adult population, as in the work of Paul Collier and associates, there is no significant effect of the variable. Also, I have found that the effect of youth bulges does not vary with regime type, but that there is some weak evidence that aspects of economic performance may influence the conflict propensity of youth cohorts.

Are we moving towards a new age of insecurity, the *Coming Anarchy* of Robert Kaplan? There is nothing in my study to support this claim, neither with regard to neo-malthusian population pressure nor to youth bulges. All the neo-malthusian variables are insignificant for the post-Cold War period. The effect of youth bulges is also insignificant for this period, while positive and significant for previous decades. This finding is more supportive of Jack Goldstone's claim that youth bulges are historically associated with conflict than of a new security paradigm. What is most striking about the post-Cold War models is the strong explanatory power of the 'traditional' explanations related to level of development, regime type and geography (the latter measured by total population).

6.1.1 Implications for Population Pressure Theory

Neo-malthusians may claim that the aggregated data used here to test population pressure hypotheses may fail to reflect local population pressure causing local conflicts. But similar criticism should also then be directed to Thomas Homer-Dixon and associates. Four out of the five cases investigated in Homer-Dixon & Blitt (1998) deal with

whole countries, while only one case study is limited to a region within a country.[40] In all these cases Homer-Dixon and associates argue that overall population growth in a country contributes to resource scarcity. This study finds that the relationship between population-induced scarcity and conflict that was found for some of the cases does not hold over a large number of countries and times.

A more relevant objection would be that the conflict data used in this study may not be ideal for the testing of neo-malthusian theory. The Uppsala dataset (Gleditsch et al., 2001) includes only conflicts where the government of the country is an active part, thereby omitting communal conflicts and other conflicts between non-governmental groups. However, most conflicts that demand 25 casualties or more are likely to involve the government of the state. If neo-malthusian population pressure can only explain the rare occasions where the government stands aside while an internal conflict is going on, or conflicts at even lower levels of intensity, it is hardly an important cause of contemporary conflict.

The significant and negative relationship between population density and conflict in some models seriously undermines the neo-malthusian position. This finding support Ester Boserup's assumption that densely populated areas are forced to develop in order to overcome resource scarcity. The fact that population density measured relative to arable land is more strongly associated with a reduction in conflict proneness than the conventional population density measure underlines this point. This may indicate that countries that have experienced population pressure more specifically related to the land available for agricultural production have had to develop and diversify economically, and that this development has eventually made countries somewhat more peaceful. The finding counters the popular 'Rwanda syndrome' conception that conflict can arise as a result of people's desire for their neighbor's piece of land and cattle. As Ferguson (1992: 61) argues; 'even when people do acquire land through war, they actually go to war for other reasons'.

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[40] The countries studied by Homer-Dixon and associates are Gaza (while the listing of Gaza as a country could of course be questioned, it is included in my study as a separate entity), South Africa, Pakistan and Rwanda. The region studied is Chiapas, Mexico.

Thomas Homer-Dixon puts a strong emphasis on the role of contextual factors like development and regime type in transforming cases of resource scarcity into armed conflict. The former decides a country's ability to overcome resource scarcity through the supply of ingenuity. Regarding the latter, weak states acts as a 'filter' defining the opportunities for violent reaction to grievance. Since I control for both these factors in my models, one could argue that I tap the effect of population-induced resource scarcity. But if these contextual factors are so powerful that the effect of neo-malthusian variables disappears, the neo-malthusian factors are hardly important as explanatory variables of conflict in themselves. Especially, if level of development decides whether countries overcome resource scarcity, the devil is in underdevelopment rather than in population pressure. Furthermore, these two contextual factors also matter in exactly the same way for most other assumed 'root causes' of conflict; less developed countries are generally less able to alleviate grievances than developed countries, and intermediary regimes, weak states, generally offer more openings for violent opposition.

An optimistic expectation that would be an alternative to the youth bulge hypothesis stated in this study is that youth bulges are likely to cause a boost in the economy through their large supply of labor. This could further be expected to reduce conflict propensity. I do not dismiss this possibility, but I believe that structural aspects of the economy will determine the significance of this effect. My study indicates that the direct positive effect of youth bulges on conflict propensity is greater than the indirect peace-conducive effect through increased labor supply. While the youth bulge hypothesis in general is supported by empirical evidence, the ways that youth bulges influences conflict propensity have not been well clarified here. There is only weak evidence for the assumption that youth bulges are especially conflict-conducive in times of poor economic performance. And youth bulges do not seem to interact with regime type in order to cause conflict. It is possible, however, that this variable is better suited to control for state weakness than to reflect whether a state has a closed recruitment system.

Unlike the neo-malthusian variables, youth bulge variables are statistically significant in models that include development and regime variables. These contextual

factors are believed to influence the conflict propensity of youth bulges in ways very similar to those assumed by Thomas Homer-Dixon. Developed and rich countries are likely to be able to 'pay off' youth bulges by increasing the capacity in the education system or by expanding the number of public sector jobs. Further, weak states more easily fall prey to youth bulges. But there is a third factor that is of great importance for determining whether the devil is in youth bulges: the possibilities for migration to other countries. Developing countries that today export a substantial part of their excess youth to more developed countries would otherwise risk a rise in youth discontent. Migration works as a safety valve. If migration opportunities are substantially restricted this is likely to cause an increased pressure from youth bulges accompanied by a higher risk of discontent and violence in many countries. Moller believes that the possibility for Europe's large youth cohorts in the 19th century to emigrate to the US is an important explanation for the absence of youth-generated violence in Europe in this period (1968: 242).

6.1.2 Future Research

New technology that is now being developed and tested may in the future provide more reliable analyses of the complex links between population, environment and conflict. GIS systems that include information from satellite pictures may better show how human activity influences the renewable resource base, and the same technology enables us to better pinpoint the exact location of conflicts. For instance, GIS methods can be used to evaluate the productive capacity of a country's soil by investigating satellite pictures revealing soil quality and adding climate zones and other potentially important factors. The application of such methods can be used for analyzing current and future conflicts to see whether neo-malthusian or cornucopian arguments may hold. The applicability of such methods for the study of past conflicts is however limited, as historical data needed for this kind of analyses are limited.

I will point to some issues of population pressure that this study leaves unanswered, but that are interesting avenues for future research. First, further investigation is needed on my material to reveal what the reasons are for the significant effect of the

population growth and density interaction in the 1970s. Since this decade was characterized by Soviet and US efforts to rally ideological allies and fight each other in third countries, it could be that the superpowers engaged in conflict in countries that they assumed had a considerable conflict potential. Such a foundation may have been high population pressure and resource scarcity, but this is speculation.

Another promising area of research is meso-level quantitative studies of certain countries, aimed at revealing possible effects on conflict propensity of neo-malthusian population pressure on local level. Potential candidates for such studies are India and Indonesia. Both countries have had a number of conflicts, considerable population growth, and face different resource degradation problems.

A third suggestion for further quantitative testing of neo-malthusian theory is to investigate the role of migration more thoroughly. This study indicates that there may be some connection between refugee populations and conflict. Future studies should try to establish a more reliable measure for refugee populations, but also pay attention to large-scale cross-country migration of non-refugees, such as the migration of Bangladeshi into the region of Assam in India. Ideally, such a study should also include a measure for internally displaced people. It would be interesting to investigate more closely whether refugees may provide a spill-over effect of conflict between countries.

The potential for further quantitative research on youth bulges is great. Especially would a more fine-grained study of interaction effects between youth bulges and economic factors that especially concern youth, such as youth unemployment rates, be of great interest. Empirical studies of the role played by education on an individual level and of the dynamic of large expansions of education are required to answer some main research questions left by the youth bulge theoretical framework provided here. A final major youth bulge issue left by this study for future projects is the role that ethnicity plays for youth-generated conflict. Both the State Failure Task Force and Samuel P. Huntington claim that ethnicity is a central feature of youth bulge riots.

In this section I have focused on further research on the types of population pressure described in this study. There is however also a third form of population pressure that I have reserved for future research; unequal growth rates between different ethnic groups in a country. My very provisional observations on this issue from my

work on the civil war in Bosnia-Hercegovina indicates that there may well be another devil in the fear of being demographically outnumbered by another ethnic or religious group. Simon (1989: 167) argues that it is really unequal growth rates between groups, and not overall population growth, that Choucri (1974) sees as support for her population growth hypothesis. Quantitative studies of the unequal growth rates hypothesis can potentially be tested both over a large number of countries over time, and on a sub-national level by comparing the changing ethnic or religious composition of regions over time.

Bibliography

Allcock, John B.; Marko Milivojevic & John H. Horton, eds, 1998. *Conflict in the Former Yugoslavia: An Encyclopedia*. Santa Barbara, CA: ABC-CLIO.

Beck, Nathaniel & Jonathan N. Katz, 2001. 'Throwing Out the Baby With the Bath Water: A Comment on Green, Kim and Yoon', *International Organization* 55(2): 487–495.

Beck, Nathaniel; Jonathan N. Katz & Richard Tucker, 1998. 'Taking Time Seriously: Time-Series-Cross-Section Analysis with a Binary Dependent Variable', *American Journal of Political Science* 42(4): 1260-1288.

Boserup, Ester, 1981. *Population and Technological Change: A Study of Long-Term Trends*. Chicago, IL: University of Chicago Press.

Boserup, Ester & T. Paul Schultz, eds, 1990. *Economic and Demographic Relationships in Development*. Baltimore, MD: Johns Hopkins University Press.

Braungart, Richard G., 1984. 'Historical and Generational Patterns of Youth Movements: A Global Perspective', *Comparative Social Research* 7(1): 3–62.

Bremer, Stuart A., 1992. 'Dangerous Dyads. Conditions Affecting the Likelihood of Interstate War, 1816-1965', *Journal of Conflict Resolution* 36(2): 309–341.

Britannica Book of the Year, annual. Chicago, IL: Encyclopedia Britannica.

Buhaug, Halvard, 2001. *Assessing the Domestic-Foreign Conflict Nexus - The Discriminating Impact of Political Systems*. Cand. polit. thesis, Department of Political Science and Sociology, University of Trondheim (NTNU).

Caldwell, John C., 1986. 'Routes to Low Mortality in Poor Countries', *Population and Development Review* 12(2): 171–220.

Caldwell, John C. & Pat Caldwell, 1987. 'The Cultural Context of High Fertility in Sub-Saharan Africa', *Population and Development Review* 13(3): 409–437.

Caldwell, John C.; I. O. Orubuloye & Pat Caldwell, 1992. 'Fertility Decline in Africa: A New Type of Transition', *Population and Development Review* 18(2): 211–242.

Choucri, Nazli, 1974. *Population Dynamics and International Violence: Propositions, Insights and Evidence*. Lexington, MA: Lexington.

CIA, annual. *The World Factbook*. Washington, DC: Central Intelligence Agency. 2001 edition available at http://www.odci.gov/cia/publications/factbook/index.html.

Cleland, John, 1993. 'Different Pathways to Demographic Transition', in F. Graham-Smith, ed., *Population - the Complex Reality. A Report of the Population Summit of the World's Scientific Academies*. Cambridge: Royal Society & North Academic Press (229–247).

Cohen, Barney, 1998. 'The Emerging Fertility Transition in Sub-Saharan Africa', *World Development* 26(8): 1431–1461.

Collier, Paul, 1999. 'On the Economic Consequences of Civil War', *Oxford Economic Papers-New Series* 51(1): 168–183.

Collier, Paul, 2000. 'Doing Well Out of War: An Economic Perspective', in Mats Berdal & David M. Malone, eds, *Greed & Grievance: Economic Agendas in Civil Wars*. Boulder, CO & London: Lynne Rienner (91–111).

Collier, Paul & Anke Hoeffler, 1998. 'On Economic Causes of Civil War', *Oxford Economic Papers* 50(4): 563–573.

Collier, Paul & Anke Hoeffler, 2002a. 'Greed and Grievance in Civil War', *Quarterly Journal of Economics* 117: forthcoming. Page-references in text refer to paper. Available at http://www.worldbank.org/research/conflict/papers.htm.

Collier, Paul & Anke Hoeffler, 2002b. 'On the Incidence of Civil War in Africa', *Journal of Conflict Resolution* 46(1): 13–28.

de Sherbinen, Alex, 1995. 'World Population Growth and US National Security', *Environmental Change & Security Project Report* (1): 24–29.

de Soysa, Indra, 2000. 'The Resource Curse: Are Civil Wars Driven by Rapacity or Paucity?', in Mats Berdal & David M. Malone, eds, *Greed and Grievance: Economic Agendas in Civil Wars*. Boulder, CO & London: Lynne Rienner (113–135).

de Soysa, Indra, 2002. 'Paradise is a Bazaar? Testing the Effects of Greed, Creed, Grievance and Governance on Civil War, 1989–99', *Journal of Peace Research* 39(4): forthcoming. Page-references in text refer to manuscript.

Dyson, Tim, 1999. 'World Food Trends and Prospects to 2025', *Proceedings of the National Academy of Sciences of the United States of America* 96(11): 5929–5936.

ECHO, 1995. 'Environmental Impacts of Sudden Population Displacements'.Brussels: European Community Humanitarian Office: Expert Consultation on Priority Policy Issues and Humanitarian Aid.

Ehrlich, Paul R., 1968. *The Population Bomb*. New York: Ballantine.

Ehrlich, Paul R. & Anne H. Ehrlich, 1996. *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens Our Future*. Washington, DC: Island Press.

Esty, Daniel C. et al., 1998. *State Failure Task Force Report: Phase II Findings*. McLean, VA: Science Applications International, for State Failure Task Force. Copies may be requested from http://www.bsos.umd.edu/cidcm/stfail/.

Falkenmark, Malin, 1990. 'Rapid Population Growth and Water Scarcity: The Predicaments of Tomorrow's Africa', *Population and Development Review* 16(supplement): 81–94.

Fearon, James D. & David D. Laitin, 2001. *Ethnicity, Insurgency, and Civil War*. Paper presented at the Annual Meeting of the American Political Science Association. San Fransisco, CA, August 30-September 2.

Ferguson, R. Brian, 1992. 'The General Consequences of War: An Amazonian Perspective', in Giorgio Ausenda, ed., *Effects of War on Society*. San Marino: AIEP (59–86).

Feuer, Lewis S., 1969. *The Conflict of Generations: The Character and Significance of Student Movements*. London: Heinemann.

Freedman, Ronald, 1997. 'Do Family Planning Programs Affect Fertility Preferences? A Literature Review', *Studies in Family Planning* 28(1): 1–13.

Gleditsch, Nils Petter, 2001a. 'Armed Conflict and the Environment', in Paul F. Diehl & Nils Petter Gleditsch, eds, *Environmental Conflict*. Boulder, CO: Westview (251–272). Earlier printed in *Journal of Peace Research* 35(3): 381–400.

Gleditsch, Nils Petter, 2001b. 'Environmental Change, Security, and Conflict', in Chester Crocker, Fen Osler Hampson & Pamela Aall, eds, *Managing Global Chaos II*. Washington, DC: United States Institute of Peace Press (53–68).

Gleditsch, Nils Petter & Totto Befring, 1986. *The Composition of the International System, 1945–86*. Manuscript, Oslo: International Peace Research Institute.

Gleditsch, Nils Petter & Håvard Hegre, 1997. 'Peace and Democracy: Three Levels of Analysis', *Journal of Conflict Resolution* 41(2): 283-310.

Gleditsch, Nils Petter; Petter Wallensteen, Mikael Eriksson, Margareta Sollenberg & Håvard Strand, 2001. *Armed Conflict 1946–2000: A New Dataset*. Paper presented at the conference called Identifying Wars: Systematic Conflict Research and its Utility in Conflict Resolution and Prevention. Uppsala: PRIO; Department of Peace and Conflict Research, Uppsala University & DECRG, World Bank, 8–9 June. Available at the conference web site: http://www.pcr.uu.se/Gleditsch_Strand_Uppsala.pdf.

Goldstone, Jack A., 1991. *Revolution and Rebellion in the Early Modern World*. Berkeley, CA: University of California Press.

Goldstone, Jack A., 1999. 'Youth Bulges, Youth Cohorts, and their Contribution to Periods of Rebellion and Revolution'. Manuscript, University of California, Davis.

Goldstone, Jack A., 2001. 'Demography, Environment, and Security', in Paul F. Diehl & Nils Petter Gleditsch, eds, *Environmental Conflict*. Boulder, CO: Westview (84–108).

Green, Donald P.; Soo Yeon Kim & David Yoon, 2001. 'Dirty Pool', *International Organization* 55(2): 441–468.

Green, Marshall, 1993. 'The Evolution of US International Population Policy, 1965–92: A Chronological Account', *Population and Development Review* 19(2): 303–321.

Gurr, Ted Robert, 1970. *Why Men Rebel*. Princeton, NJ: Princeton University Press.

Hauge, Wenche & Tanja Ellingsen, 2001. 'Causal Pathways to Conflict', in Paul F. Diehl & Nils Petter Gleditsch, eds, *Environmental Conflict*. Boulder, CO: Westview (36–57). Earlier printed in *Journal of Peace Research* 35(3): 299–318.

Hegre, Håvard, 2000. 'Development and the Liberal Peace: What does It Take to Be a Trading State?', *Journal of Peace Research* 37(1): 5–30.

Hegre, Håvard; Tanja Ellingsen, Scott Gates & Nils Petter Gleditsch, 2001. 'Toward a Democratic Civil Peace? Democracy, Political Change, and Civil War, 1816–1992', *American Political Science Review* 95(1): 33–48.

Henderson, Errol A. & J. David Singer, 2000. 'Civil War in the Post-Colonial World, 1946–92', *Journal of Peace Research* 37(3): 275–299.

Homer-Dixon, Thomas F., 1991. 'On the Threshold: Environmental Changes as Causes of Acute Conflict', *International Security* 16(2): 76–116.

Homer-Dixon, Thomas F., 1994. 'Environmental Scarcities and Violent Conflict', *International Security* 19(1): 5–40.

Homer-Dixon, Thomas F., 1995. 'The Ingenuity Gap: Can Poor Countries Adapt to Resource Scarcity?', *Population and Development Review* 19(1): 587–612.

Homer-Dixon, Thomas F. & Jessica Blitt, 1998. *Ecoviolence: Links Among Environment, Population and Security*. Lanham, MD: Rowman & Littlefield.

Hughes, Patrick M., 1997. *Global Threats and Challenges to the United States and its Interests Abroad*. Statement For The Senate Select Committee On Intelligence 5 February and The Senate Armed Services Committee On Intelligence 6 February. Washington, DC: Defence Intelligence Agency. Available at http://www.fas.org/irp/congress/1997_hr/s970205d.htm.

Huntington, Samuel P., 1996. *The Clash of Civilizations and the Remaking of World Order*. New York: Simon & Schuster.

Jaggers, Keith & Ted Robert Gurr, 1995. 'Tracking Democracy´s Third Wave with the Polity III Data', *Journal of Peace Research* 32(4): 469–482. Data available at http://www.bsos.umd.edu/cidcm/polity.

Jejeebhoy, Shireen J., 1995. *Women's Education, Autonomy and Reproductive Behavior: Experience from Developing Countries*. Oxford & New York: Clarendon.

Jones, Huw R., 1990. *Population Geography*. London: Paul Chapman.

Kahl, Colin H., 1998. 'Population Growth, Environmental Degradation, and State-Sponsored Violence: The Case of Kenya, 1991–93', *International Security* 23(2): 80–119.

Kaplan, Robert D., 1994. 'The Coming Anarchy', *Athlantic Monthly* 273(2): 44–76.

Kelley, Allen C. & Robert M. Schmidt, 1995. 'Aggregate Population and Economic Growth Correlations: The Role of the Components of Demographic Change', *Demography* 32(4): 543–555.

King, Gary, 2001. ‘Proper Nouns and Methodological Propriety: Pooling Dyads in International Relations Data’, *International Organization* 55(2): 497–507.

King, Gary; Robert O. Keohane & Sidney Verba, 1994. *Designing Social Inquiry. Scientific Inference in Qualitative Research*. Princeton, NJ: Princeton University Press.

King, Gary; James Honaker, Anne Joseph & Kenneth Scheve, 2001. ‘Analyzing Incomplete Political Science Data: An Alternative Algorithm for Multiple Imputation’, *American Political Science Review* 95(1): 49-69.

King, Gary & Langche Zeng, 2001. ‘Improving Forecasts of State Failure’, *World Politics* 53(4): 623–658.

Le Billon, Philippe, 2001. ‘The Political Ecology of War: Natural Resources and Armed Conflicts’, *Political Geography* 20(5): 561–584.

Lee, Ronald, 1990. ‘The Demographic Response to Economic Crisis in Historical and Contemporary Populations’, *Population Bulletin of the UN* 29: 1–15.

Levy, Mark, 1995. ‘Is the Environment a National Security Issue?’, *International Security* 20(2): 35–62.

Lieberson, Stanley, 1991. ‘Small N's and Big Conclusions - An Examination of the Reasoning in Comparative-Studies Based on a Small Number of Cases’, *Social Forces* 70(2): 307–320.

Lomborg, Bjørn, 2001. *The Skeptical Environmentalist: Measuring the Real State of the World*. Cambridge: Cambridge University Press.

Malthus, Thomas Robert, 1803/1992. *An Essay on the Principle of Population*. Reprinted, Cambridge: Cambridge University Press.

Marshall, Monty G. & Keith Jaggers, 2000. *Polity IV Project: Political Regime Characteristics and Transitions, 1800–1999*. University of Maryland, MD: CIDCM. Codebook and data available at http://www.bsos.umd.edu/cidcm/polity/.

Mason, Andrew, 1993. ‘The Response of Fertility and Mortality to Economic Crisis and Structural Adjustment Policy During the 1980s: A Review’'. Montreal: International Population Conference (411–429).

Mason, Karen O., 1997. ‘Explaining Fertility Transitions’, *Demography* 34(4): 443–454.

Moller, Herbert, 1968. ‘Youth as a Force in the Modern World’, *Comparative Studies in Society and History* 10: 238–260.

Myers, Norman, 1993. *Ultimate Security: The Environmental Basis of Political Stability*. New York: Norton.

Myers, Norman & Julian Simon, 1994. *Scarcity and Abundance? A Debate on the Environment*. New York & London: Norton.

Ohlsson, Leif, 1999. *Environment, Scarcity and Conflict: A Study of Malthusian Concerns*. PhD Dissertation. Göteborg: Department of Peace and Development Research, Göteborg University.

Oneal, John R. & Bruce M. Russett, 1999. 'Assessing the Liberal Peace with Alternative Specifications: Trade Still Reduces Conflict', *Journal of Peace Research* 36(4): 423-442.

Oneal, John R. & Bruce M. Russett, 2001. 'Clear and Clean: The Fixed Effects of the Liberal Peace', *International Organization* 55(2): 469–485.

Pearce, Fred, 2001. 'Desert Harvest', *New Scientist* 172(2314): 44–48.

Prunier, Gérard, 1995. *The Rwanda Crisis 1959–1994: History of a Genocide*. London: Hurst.

Raknerud, Arvid & Håvard Hegre, 1997. 'The Hazard of War: Reassessing the Evidence for the Democratic Peace', *Journal of Peace Research* 34(4): 385-404.

Rasler, Karen A. & William R. Thompson, 1992. 'Assessing the Costs of War: A Preliminary Cut', in Giorgio Ausenda, ed., *Effects of War on Society*. San Marino: AIEP (245–279).

Reddy, Marlita A., ed., 1994. *Statistical Abstract of the World*. Detroit, MI: Gale Research.

Renner, Michael, 1996. *Fighting for Survival: Environmental Decline, Social Conflict, and the New Age of Insecurity*. Environmental Alert Series. New York: Norton.

Russett, Bruce M. & John R. Oneal, 2001. *Triangulating Peace: Democracy, Interdependence, and International Organizations*. New York: Norton.

Sambanis, Nicholas, 2002. 'A Review of Recent Advances and Future Directions in the Quantitative Literature on Civil War', *Defence and Peace Economics* 13(3): forthcoming. Page-references in text refer to manuscript.

Schwartz, Daniel M.; Tom Deligiannis & Thomas F. Homer-Dixon, 2000. 'The Environment and Violent Conflict: A Response to Gleditsch's Critique and Some Suggestions for Future Research', *Environmental Change and Security Project Report* (6): 77–94. Reprinted in revised form in Paul F. Diehl & Nils Petter Gleditsch, eds, *Environmental Conflict*. Boulder, CO: Westview.

Sciolino, Elaine, 2001. 'Is the Devil in the Demographics? ', *New York Times*, December 9. Available at http://www.globalpolicy.org/wtc/fundamentalism/1209radicalism.htm.

Sen, Amartya, 1998. 'Mortality as an Indicator of Economic Success and Failure', *Economic Journal* 108(446): 1–25.

Simon, Julian, 1981. *The Ultimate Resource*. Princeton, NJ: Princeton University Press.

Simon, Julian L., 1989. 'Lebensraum: Paradoxically, Population Growth May Eventually End Wars', *Journal of Conflict Resolution* 33(1): 164–180.

Singer, J. David & Melvin Small, 1994. *Correlates of War Project: International and Civil War Data, 1816–1992*. Ann Arbor, MI: ICPSR. Codebook and computer file, ICPSR no. 9905, data also at http://www.umich. edu/~cowproj/.

Suhrke, Astri, 1997. 'Environmental Degradation, Migration and the Potential for Violent Conflict', in Nils Petter Gleditsch, ed., *Conflict and the Environment*. Dordrecht: Kluwer (255–272).

Summers, Robert & Alan Heston, 1991. 'The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950–1988', *Quarterly Journal of Economics* 106(2): 327–368.

Tir, Jaroslav & Paul F. Diehl, 2001. 'Demographic Pressure and Interstate Conflict', in Paul F. Diehl & Nils Petter Gleditsch, eds, *Environmental Conflict*. Boulder, CO: Westview (58–83). Earlier printed in *Journal of Peace Research* 35(3): 319–340.

Toset, Hans Petter Wollebæk; Nils Petter Gleditsch & Håvard Hegre, 2000. 'Shared Rivers and Interstate Conflict', *Political Geography* 19(8): 971–996.

Trolldalen, Jon Martin; Nina M. Birkeland, Jan Borgen & Preston T. Scott, 1992. 'Environmental Refugees: A Discussion Paper'. Oslo: World Foundation for Environment and Development and The Norwegian Refugee Council (2–29).

UN, 1999. *World Population Prospects: The 1998 Revision*. New York: United Nations.

UN, annual. *Demographic Yearbook*. New York: United Nations.

UNHCR, 1998. 'Refugees and Others of Concern to UNHCR: 1997 Statistical Overview'.Geneva: United Nations High Commissioner for Refugees. Available at http://www.unhcr.ch.

UNHCR, 1999. 'Refugees and Others of Concern to UNHCR: 1998 Statistical Overview'.Geneva: United Nations High Commissioner for Refugees. Available at http://www.unhcr.ch.

UNHCR, 2000. 'Refugees and Others of Concern to UNHCR: 1999 Statistical Overview'.Geneva: United Nations High Commissioner for Refugees. Available at http://www.unhcr.ch.

Vanhanen, Tatu, 2000. 'A New Dataset for Measuring Democracy, 1810–1998', *Journal of Peace Research* 37(2): 251–265.

Wallensteen, Peter & Margareta Sollenberg, 2001. 'Armed Conflict, 1989–2000', *Journal of Peace Research* 38(5): 629–644.

World Bank, 1999a. *World Development Indicators 1999*. Washington, DC: Development Data Center, International Bank for Reconstruction and Development.

World Bank, 1999b. *World Development Report 1999/2000: Entering the 21st Century*. New York: Oxford University Press, for the World Bank.

Zakaria, Fareed, 2001. 'The Roots of Rage', *Newsweek* 138(16): 14–33.

Appendices

Appendix 1: All Countries and Periods Included in the Analyses

Code	Country	Time	Code	Country	Time
2	United States of America	1950-2000	165	Uruguay	1950-2000
20	Canada	1950-2000	200	United Kingdom	1950-2000
31	Bahamas	1950-2000	205	Ireland	1950-2000
40	Cuba	1950-2000	210	Netherlands	1950-2000
41	Haiti	1950-2000	211	Belgium	1950-2000
42	Dominican Republic	1950-2000	212	Luxemburg	1950-2000
51	Jamaica	1950-1957	220	France	1950-2000
51	Jamaica	1963-2000	221	Monaco	1950-2000
52	Trinidad and Tobago	1950-1957	223	Liechtenstein	1950-2000
52	Trinidad and Tobago	1963-2000	225	Switzerland	1950-2000
53	Barbados	1950-1957	230	Spain	1950-2000
53	Barbados	1963-2000	232	Andorra	1950-2000
54	Dominica	1957-1957	235	Portugal	1950-2000
54	Dominica	1963-2000	255	Germany	1991-2000
55	Grenada	1957-1957	260	German Federal Republic	1950-1990
55	Grenada	1963-2000	265	German Democratic Republic	1950-1990
56	St. Lucia	1957-1957	290	Poland	1950-2000
56	St. Lucia	1963-2000	305	Austria	1950-2000
57	St. Vincent and the Grenadines	1957-1957	310	Hungary	1950-2000
57	St. Vincent and the Grenadines	1963-2000	315	Czechoslovakia	1950-1992
58	Antigua & Barbuda	1957-1957	316	Czech Republic	1993-2000
58	Antigua & Barbuda	1963-2000	317	Slovakia	1993-2000
60	St. Kitts-Nevis	1957-1957	325	Italy	1950-2000
60	St. Kitts-Nevis	1963-2000	331	San Marino	1950-2000
70	Mexico	1950-2000	338	Malta	1950-2000
80	Belize	1950-2000	339	Albania	1950-2000
90	Guatemala	1950-2000	343	Macedonia	1993-2000
91	Honduras	1950-2000	344	Croatia	1992-2000
92	El Salvador	1950-2000	345	Yugoslavia	1950-2000
93	Nicaragua	1950-2000	346	Bosnia-Herzegovina	1992-2000
94	Costa Rica	1950-2000	349	Slovenia	1992-2000
95	Panama	1950-2000	350	Greece	1950-2000
100	Colombia	1950-2000	352	Cyprus	1950-2000
101	Venezuela	1950-2000	355	Bulgaria	1950-2000
110	Guyana	1950-2000	359	Moldova	1992-2000
115	Surinam	1950-2000	360	Rumania	1950-2000
130	Ecuador	1950-2000	365	Russia	1950-2000
135	Peru	1950-2000	366	Estonia	1992-2000
140	Brazil	1950-2000	367	Latvia	1992-2000
145	Bolivia	1950-2000	368	Lithuania	1992-2000
150	Paraguay	1950-2000	369	Ukraine	1992-2000
155	Chile	1950-2000	370	Belarus	1992-2000

160 Argentina	1950-2000	371 Armenia	1992-2000
372 Georgia	1992-2000	560 South Africa	1950-2000
373 Azerbaijan	1992-2000	565 Namibia	1950-2000
375 Finland	1950-2000	570 Lesotho	1950-2000
380 Sweden	1950-2000	571 Botswana	1950-2000
385 Norway	1950-2000	572 Swaziland	1950-2000
390 Denmark	1950-2000	580 Malagasy Republic	1950-2000
395 Iceland	1950-2000	581 Comoros	1950-2000
402 Cape Verde	1950-2000	590 Mauritius	1950-2000
403 Sao Tome-Principe	1950-2000	591 Seychelles	1950-2000
404 Guinea-Bissau	1950-2000	600 Morocco	1950-2000
411 Equatorial Guinea	1950-2000	615 Algeria	1950-2000
420 Gambia	1950-2000	616 Tunisia	1950-2000
432 Mali	1961-2000	620 Libya	1950-2000
433 Senegal	1961-2000	625 Sudan	1950-2000
434 Benin	1959-2000	630 Iran	1950-2000
435 Mauritania	1959-2000	640 Turkey	1950-2000
436 Niger	1959-2000	645 Iraq	1950-2000
437 Ivory Coast	1959-2000	651 Egypt	1950-1957
438 Guinea	1959-2000	651 Egypt	1962-2000
439 Burkina Faso	1959-2000	652 Syria	1950-1957
450 Liberia	1950-2000	652 Syria	1962-2000
451 Sierra Leone	1950-2000	660 Lebanon	1950-2000
452 Ghana	1957-2000	663 Jordan	1950-2000
461 Togo	1950-2000	666 Israel	1950-2000
471 Cameroun	1950-2000	670 Saudi Arabia	1950-2000
475 Nigeria	1950-2000	678 Yemen Arab Republic	1950-1989
481 Gabon	1958-2000	679 Yemen	1990-2000
482 Central African Republic	1958-2000	680 Yemen People's Republic	1950-1989
483 Chad	1958-2000	690 Kuwait	1950-2000
484 Congo	1958-2000	692 Bahrain	1950-2000
490 Zaire	1950-2000	694 Qatar	1950-2000
500 Uganda	1950-2000	696 United Arab Emirates	1950-2000
501 Kenya	1950-2000	698 Oman	1950-2000
510 Tanzania	1950-2000	700 Afghanistan	1950-2000
511 Zanzibar	1950-1963	701 Turkmenistan	1992-2000
516 Burundi	1962-2000	702 Tajikistan	1992-2000
517 Rwanda	1962-2000	703 Kyrgyz Republic	1992-2000
520 Somalia	1960-2000	704 Uzbekistan	1992-2000
522 Djibouti	1950-2000	705 Kazakhstan	1992-2000
530 Ethiopia	1950-2000	710 China	1950-2000
531 Eritrea	1950-1952	712 Mongolia	1950-2000
531 Eritrea	1993-2000	713 Republic of China	1950-2000
540 Angola	1950-2000	731 Korea, North	1950-2000
541 Mozambique	1950-2000	732 Korea,South	1950-2000
551 Zambia	1950-1953	740 Japan	1950-2000
551 Zambia	1964-2000	750 India	1950-2000
552 Zimbabwe	1950-1953	760 Bhutan	1950-2000
552 Zimbabwe	1964-2000	770 Pakistan	1950-2000
553 Malawi	1950-1953	771 Bangladesh	1972-2000

553 Malawi	1964-2000	775 Burma	1950-2000
780 Sri Lanka	1950-2000	1203 Federation of Mali	1959-1960
781 Maldive Islands	1950-2000	1205 Ruanda-Urundi	1950-1961
790 Nepal	1950-2000	1204 Fed of Rhodesia and Nyasaland	1954-1963
800 Thailand	1950-2000	1201 French West Africa	1950-1958
811 Cambodia	1950-2000	1202 French Equatorial Africa	1950-1958
812 Laos	1950-2000	1206 United Arab Republic	1958-1961
816 Vietnam, Dem. Rep. of	1950-2000	1001 Leeward isls	1950-1956
817 Vietnam, Republic of	1954-1975	1003 West Indies	1958-1962
820 Malaysia	1950-2000	1002 Windward isl	1950-1956
830 Singapore	1950-1962	1401 Pacific isls	1950-1975
830 Singapore	1966-2000	1220 Reunion	1950-2000
835 Brunei	1950-2000	1210 Western Sahara	1958-2000
840 Philippines	1950-2000	1040 Guadeloupe	1950-2000
850 Indonesia	1950-2000	1020 Martinique	1950-2000
900 Australia	1950-2000	1030 Netherlands Antilles	1950-2000
910 Papua New Guinea	1950-2000	1010 Puerto Rico	1950-2000
920 New Zealand	1950-2000	1340 East Timor	1950-2000
935 Vanuatu	1950-2000	1310 Gaza	1950-2000
940 Solomon Islands	1950-2000	1330 Hong Kong	1950-2000
950 Fiji	1950-2000	1320 Macau	1950-2000
983 Marshall Islands	1976-2000	1420 French Polynesia	1950-2000
986 Palau	1976-2000	1430 Guam	1950-2000
987 Federated States of Micronesia	1976-2000	1410 New Caledonia	1950-2000
990 Western Samoa	1950-2000		

Note: Country numbers refer to the Singer & Small (1994) numbers. Countries with discontinuous appearances in the international systems are listed for all uninterrupted periods.

Appendix 2: Descriptive Statistics

Variables	*N*	*Mean*	*St.d.*	*Min*	*Max*
Population Pressure Variables					
Population Growth	9,183	2.07	1.71	-32.3	16.66
Population Density, Arable (LN)	9,004	4.29	1.89	0	13.98
Population Density, Total Land (LN)	9,159	3.76	1.71	0	10.07
Growth x Density	9,004	8.61	9.49	-172.25	103.05
Growth x Infant Mortality Rate	8,797	8.82	7.00	-119.95	60.87
Refugees	2,340	0.14	0.35	0	1
Youth Bulges	8,723	29.80	6.29	9.6	45
Youth Bulges, Squared	8,723	927.39	347.36	92.16	2025
Youth Bulges x Economic Opportunities	8,723	58.83	113.76	-647.29	1530.9
Youth Bulges x Regime Type	8,723	-23.92	185.89	-388	374
Control Variables					
Total Population (LN)	9,183	8.01	2.20	1.79	14.06
Dependency	9,183	0.23	0.42	0	1
Infant Mortality Rate (LN)	8,797	4.00	0.98	0.69	5.58
Infant Mortality Rate (LN), Squared	8,797	16.96	7.30	0.48	31.09
Regime Type	9,183	-0.25	6.39	-10	10
Regime Type, Squared	9,183	40.90	37.63	0	100
Missing Regime Data	9,183	0.31	0.46	0	1
Economic Opportunities	9,183	2.03	3.58	-28.61	44.50
Missing Economic Data	9,183	0.24	0.42	0	1
GDP per Capita (LN)	9,183	7.83	0.94	5.19	10.83
GDP per Capita (LN), Squared	9,183	62.26	14.68	26.91	117.30
Missing GDP Data	9,183	0.24	0.43	0	1
Communist State Dissolution	9,183	0.01	0.10	0	1
Controls for Statistical Dependency					
Previous Conflict	9,183	0.43	0.90	0	7
Brevity of Peace (3 Years)	9,183	0.15	0.33	0	1
Ongoing Conflict in Country	9,183	0.10	0.30	0	1

Note: Number of country-years with originally missing values in brackets: Regime Type (2,866), Economic Opportunities (2,167), GDP per Capita (2,202).

Appendix 3: Correlation Matrix for Parameter Estimates From Model 12

	YB	YB2	Com	TP	Dep	IMR	Reg	Re2	ReM	PC	BP	Con
Youth Blg	1.00											
Youth Blg, sq.	-0.09	1.00										
Communist SD	0.31	-0.16	1.00									
Tot Pop	0.25	0.07	0.07	1.00								
Dependency	0.15	0.08	-0.01	0.17	1.00							
IMR	-0.44	0.40	0.11	-0.11	-0.13	1.00						
Regime	0.05	-0.01	0.08	-0.09	-0.03	0.28	1.00					
Regime, sq	0.19	-0.06	0.19	-0.02	0.01	0.06	0.07	1.00				
Regime, miss	0.02	-0.06	0.13	0.16	-0.57	0.01	-0.07	0.42	1.00			
Previous Conf	-0.23	0.08	0.09	-0.34	-0.04	0.24	0.17	-0.00	0.02	1.00		
Brevity Peace	0.06	-0.10	-0.16	0.03	0.17	-0.19	-0.09	0.06	-0.12	-0.55	1.00	
Constant	-0.29	-0.23	-0.16	-0.91	-0.19	-0.05	0.06	-0.27	-0.29	0.21	-0.05	1.00

Appendix 4: Correlation Matrix for Parameter Estimates From Model 13

	YB	YB2	Com	TP	Dep	Gdp	GM	Reg	Re2	RM	PC	BP	Con
Youth Blg	1.00												
Youth Blg, sq.	0.06	1.00											
Communist	0.38	-0.20	1.00										
Tot Pop	0.25	0.09	0.06	1.00									
Dependency	0.10	0.16	0.08	0.11	1.00								
GDP cap	0.29	-0.16	0.11	0.12	0.00	1.00							
GDP miss	-0.07	-0.03	-0.30	0.05	-0.22	-0.39	1.00						
Regime	0.11	-0.07	0.04	-0.07	0.03	-0.28	0.03	1.00					
Regime, sq	0.22	-0.08	0.16	-0.00	-0.00	-0.02	0.08	0.04	1.00				
Regime, miss	0.05	-0.08	0.14	0.20	-0.54	0.05	-0.03	-0.08	0.42	1.00			
Previous Conf	-0.13	0.02	0.10	-0.34	0.04	-0.06	-0.11	0.12	-0.02	-0.00	1.00		
Brevity Peace	0.00	-0.05	-0.13	0.02	0.12	0.12	-0.02	-0.09	0.07	-0.09	-0.51	1.00	
Constant	-0.33	-0.22	-0.11	-0.91	-0.25	0.01	-0.13	0.06	-0.29	-0.32	0.24	-0.06	1.00

Appendix 5: Correlation Matrix, All Variables

	PGr	PDA	PDT	GxD	GxI	Ref	YB	YB2	YxE	YxR	TP	Dep	IMR	IM2	Reg	R2	MR	EO	ME	Gdp	G2	MG	CSD	PC	BP3	OC
PGr	1.00																									
PDA	-0.10	1.00																								
PDT	-0.21	0.92	1.00																							
GxD	0.83	0.37	0.22	1.00																						
GxI	0.96	-0.18	-0.30	0.70	1.00																					
Ref	0.06	-0.06	-0.04	0.03	0.10	1.00																				
YB	0.40	-0.21	-0.27	0.21	0.50	0.09	1.00																			
YB2	0.38	-0.20	-0.25	0.21	0.49	0.12	0.99	1.00																		
YxE	-0.05	0.05	0.04	-0.04	-0.04	-0.01	0.07	0.06	1.00																	
YxR	-0.22	0.06	0.13	-0.16	-0.29	-0.09	-0.34	-0.33	0.01	1.00																
TP	-0.10	-0.08	-0.03	-0.10	-0.10	0.37	-0.11	-0.11	-0.02	-0.01	1.00															
Dep	0.08	0.10	0.07	0.10	0.09	-0.12	0.07	0.06	0.07	0.05	-0.56	1.00														
IMR	0.31	-0.33	-0.37	0.10	0.51	0.12	0.67	0.65	0.02	-0.43	-0.01	0.13	1.00													
IM2	0.29	-0.34	-0.38	0.08	0.49	0.14	0.64	0.61	0.02	-0.42	-0.01	0.14	0.99	1.00												
Reg	-0.23	0.05	0.12	-0.18	-0.32	-0.06	-0.40	-0.38	0.00	0.97	0.02	0.01	-0.48	-0.46	1.00											
R2	-0.10	-0.10	-0.09	-0.10	-0.16	0.04	-0.37	-0.35	-0.01	0.10	0.45	-0.56	-0.32	-0.31	0.19	1.00										
MR	0.02	0.15	0.13	0.06	0.04	-0.16	0.14	0.13	0.04	0.08	-0.66	0.78	0.08	0.08	0.03	-0.73	1.00									
EO	-0.09	0.08	0.09	-0.07	-0.10	-0.02	-0.05	-0.05	0.98	0.05	0.00	0.05	-0.05	-0.05	0.05	0.02	0.02	1.00								
ME	0.05	0.04	-0.01	0.04	0.09	-0.08	0.09	0.07	0.02	-0.01	-0.40	0.61	0.19	0.21	-0.04	-0.40	0.51	-0.00	1.00							
Gdp	-0.10	0.19	0.16	0.02	-0.25	-0.14	-0.53	-0.51	0.06	0.41	-0.18	0.15	-0.67	-0.67	0.43	0.16	0.13	0.11	0.07	1.00						
G2	-0.09	0.19	0.16	0.03	-0.25	-0.13	-0.54	-0.52	0.05	0.41	-0.17	0.13	-0.68	-0.68	0.43	0.18	0.11	0.10	0.06	0.99	1.00					
MG	-0.01	0.13	0.09	0.03	-0.01	-0.05	-0.00	-0.00	-0.06	0.10	-0.34	0.50	-0.04	-0.03	0.08	-0.36	0.46	-0.08	0.60	0.25	0.22	1.00				
CSD	-0.09	-0.01	0.01	-0.07	-0.10	0.01	-0.13	-0.13	-0.15	0.03	0.04	-0.06	-0.09	-0.10	0.03	-0.00	-0.06	-0.19	0.04	0.03	0.03	0.13	1.00			
PC	0.05	-0.02	0.01	0.04	0.06	0.26	0.19	0.19	-0.04	-0.12	0.35	-0.22	0.08	0.06	-0.12	0.03	-0.20	-0.06	-0.18	-0.17	-0.18	-0.05	-0.01	1.00		
BP3	0.03	-0.05	-0.03	0.01	0.07	0.16	0.22	0.22	-0.10	-0.04	0.27	-0.10	0.21	0.20	-0.05	-0.07	-0.05	-0.13	-0.08	-0.22	-0.21	-0.03	0.04	0.39	1.00	
OC	0.03	-0.03	-0.01	0.01	0.06	0.13	0.18	0.18	-0.06	-0.01	0.20	-0.03	0.17	0.17	-0.02	-0.07	-0.00	-0.08	-0.04	-0.16	-0.15	-0.01	0.01	0.17	0.88	1.00

Note: For full variable names, see Appendix 2. Variables are presented in the same order as in Appendix 2.